Document 2: Electrotherapy in the treatment of cancer and viruses - examples of papers and patents

1. Historical review http://www.curecancer.tv/Maquinaspasadas.htm pgs 2-29
2. Use of Electrotherapy in Germany pgs 29-31 http://translate.google.com/translate?hl=en&sl=de&u=http://www.gesundheit-aktuell.de/Krebs_mit_Strom_bekaempfen_-_Die_Electro.973.0.html&prev=/search%3Fq%3D%2522electro%2Bcancer%2Btherapy%2522%26num%3D100%26hl%3Den%26lr%3D%26sa%3DG%26as_qdr%3Dall
3. Review of types of cancer electrotherapy pgs 32-39 http://www.healingcancernaturally.com/cancer-healing-greatest-hits.html
4. Old Dominion University, Center for Bioelectrics, 830 Southampton Ave., Suite 5100, Norfolk, VA-23510 757.683.3000 (pgs 40-51) http://www.odu.edu/engr/bioelectrics/research.html
5. The Electrical Properties of Cancer Cells Presented at Rife 2003 International Conference in Seattle, WA (pgs 51-113) www.holman.net/rifetechnology/ refandres/papers_articles.html
6. US patent Application 20040044338 March 4, 2004 (pgs 113-129). On the use of microcurrent to treat cancer patients http://appft1.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PG01&p=1&u=%2Fnetahtml%2FPTO%2Fsrchnum.html&r=1&f=G&l=50&s1=%2220040044338%22.PGNR.&OS=DN/20040044338&RS=DN/20040044338
7. US patent 6,676,686 January 13, 2004 (pgs 129-149). Noninvasive detection and activation of the lymphatic system in treating disease and alleviating pain (Using surface electrical stimulation) http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=/netahtml/search-adv.htm&r=1&p=1&f=G&l=50&d=ptxt&S1=((electrical+AND+cancer)+AND+microcurrent)&OS=electrical+and+cancer+and+microcurrent&RS=((electrical+AND+cancer)+AND+microcurrent)
8. US patent 6,275,735 August 14, 2001 (pgs 149-173). Methods and apparatus for electrical microcurrent stimulation therapy http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=/netahtml/search-adv.htm&r=9&p=1&f=G&l=50&d=ptxt&S1=((electrical+AND+cancer)+AND+microcurrent)&OS=electrical+and+cancer+and+microcurrent&RS=((electrical+AND+cancer)+AND+microcurrent)
9. US patent 6,155,966 December 5, 2000 (pgs 173-187). Apparatus and method for toning tissue with a focused, coherent electromagnetic field http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=/netahtml/search-adv.htm&r=11&p=1&f=G&l=50&d=ptxt&S1=((electrical+AND+cancer)+AND+microcurrent)&OS=electrical+and+cancer+and+microcurrent&RS=((electrical+AND+cancer)+AND+microcurrent)
10. US patent 6,235,251 May 22, 2001 (pgs 187-200). System and method for treating cells using electromagnetic-based radiation http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=/netahtml/search-adv.htm&r=5&f=G&l=50&d=PTXT&p=1&p=1&S1=(rife+AND+cancer)&OS=rife+and+cancer&RS=(rife+AND+cancer)

11. US patent 6,268,200 July 31, 2001 (pgs 200-221). Biotherapeutic virus attenuation using variable frequency microwave energy. http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=/netahtml/search-adv.htm&r=70&f=G&l=50&d=PTXT&p=1&p=2&S1=(((viral+AND+electromagnetic)+AND+treatment)+AND+sterilization)&OS=viral+and+electromagnetic+and+treatment+and+sterilization&RS=(((viral+AND+electromagnetic)+AND+treatment)+AND+sterilization)
12. US patent 5,915,161 June 22, 1999 (pgs 221-248) Microbe stunning device for a biological decontamination system http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=/netahtml/search-adv.htm&r=107&f=G&l=50&d=PTXT&p=1&p=3&S1=(((viral+AND+electromagnetic)+AND+treatment)+AND+sterilization)&OS=viral+and+electromagnetic+and+treatment+and+sterilization&RS=(((viral+AND+electromagnetic)+AND+treatment)+AND+sterilization)
13. US patent 5,139,684 August 18, 1992 (pgs 248-27). Electrically conductive methods and systems for treatment of blood and other body fluids and/or synthetic fluids with electric forces http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=/netahtml/search-adv.htm&r=71&f=G&l=50&d=PTXT&p=1&p=2&S1=(electrification+AND+blood)&OS=electrification+and+blood&RS=(electrification+AND+blood)

Historical review (pgs 2-29)

http://www.curecancer.tv/Maquinaspasadas.htm

[THE LANCET] THE GOVERNMENT AND THE MEDICAL PROFESSION. [JAN.10, 1880]

THE LANCET.

LONDON: SATURDAY, JANUARY 10, 1880.

THERAPEUTIC EFFECTS OF LIGHTNING UPON **CANCER**.
To the Editor of THE LANCET.

SIR,-As I am not aware that the records of the healing art furnish any case of **cancer** having yielded to the influence of lightning, I venture to draw the attention of the numerous readers of THE LANCET to the following remarkable case, which may awaken due interest in the curative value of electricity in diseases of a malignant type. Many years ago I heard the late Dr. Golding Bird express an opinion to the effect that electrical sparks drawn from a cancerous structure until an eruption is produced was the only reliable means of cure which he could endorse. In confirmation of the theory of the celebrated electrician, I beg to submit an extraordinary instance of the therapeutic freaks of atmospherical electricity in the cure of **cancer**. The case loses none of its interest on the plea of antiquity.

About thirty years ago, I attended Reuben S,---, a farm labourer, residing at Langtoft, on the Yorkshire Wolds, who suffered from **cancer** of the inferior lip and part of the chin for about a year, and who had agreed to an operation for their removal. In the meantime he under took to assist a poor farmer for a day in ploughing his land. During this Occupation he was struck down by lightning, and carried home in a state of insensibility. Both of his horses were killed, and the wooden beam of the plough was split and reduced to considerable fragments. Soon after the occurrence I visited, and found the ploughman in a state of great prostration, and emitting a strong odour of ozone, indicating electrical condensation of the adherent oxygen. As soon as reaction took place I bled him from the arm, which act constituted the whole of the treatment. What seems to be the most astonishing feature in the case is the healing process which was set up in the lip and chin soon after the accident. The **cancer** gradually lessened, and in a few weeks every trace of the diseased structure disappeared, and for ten years he enjoyed complete freedom from his former suffering and signs of the disease. In proof of the specific and hereditary character of the disorder, I may sate that the patient's granddaughter, Mrs. P-, of Driffield, lately became the subject of a cancerous tumour over the larynx, which growth, assisted by Dr. Rames, I removed successfully a few weeks ago, and under the persistent use of arsenical treatment the cure seems to be satisfactory. In S-'s case the electrical fluid seemed to form and pass through two small holes in the head-band of his trousers, and to make its exit by corresponding apertures. After this remarkable exemption from all cancerous development for so long a period, the disease reappeared, and, after a year of intense suffering, proved fatal ; still leaving the inference unaffected, that the imponderable element secured for the patient an extension of life, and ten years' relief from the distressing consequences of carcinoma, which circumstance establishes my faith in the therapeutic power of electricity in scirrhous indurations. From the foregoing representation, it is evident that frictional electricity may in good hands become one of the most powerful therapeutic agents in the dispersion of cancerous formations. When cellular hypertrophy takes place in localities favourable to the development of epithelial disease, frictional electricity might be employed for the purpose of destroying the morbid cells, whether in their incipient or advanced stages of progression. The authorities of the London **Cancer** Hospital will be unfaithful to their honourable trust should they decline to test to the fullest extent the curative effects of frictional electricity in some of the most hopeless variety of diseases to which humanity is exposed. I shall not venture upon any theory of the specific action of electricity on morbid depositions but consign the whole question to the abler readers of your incomparable **journal**.

I remain, Sir, yours &c., A. ALLISON, M.D., Senior Surgeon to the Lloyd Cottage Hospital, Bridlington.

Más tarde, hubo pioneros que han obtenido resultados tratando al cáncer con corrientes eléctricas y ondas electromagnéticas con resultados diversos, siendo Priore el de mayor impacto mediático en los años 60-70.

Otros pioneros han sido Lakhovsky, Rife, Abrahms, Edwards, el Dr. Bare, y más recientemente los Doctores Med. Rudolf Pekar y Seessle, el Prof. Dr. F. Gerlach, Dr. Ivan Stroyer, Medico jefe de la Clínica Universitaria de Herlev, Dinamarca, Prof. Dr. Guiseppe Gasso, Médico Jefe del Centro Catanese de Oncologia, El Profesor Nordenström en Dinamarca y en la actualidad, son cientos de médicos oncólogos que emplean el sistema ECT en el mundo como sistema eficiente de tratamiento, en base a los estudios, libros e informes publicados.

La base de estos resultados radica en un estudio de 9.000 casos en 168 clínicas bajo la dirección del Profesor Universitario Dr. Xin Yu Ling, Beijing, China. (ISBN 3-85175-776-9). Dicho trabajo de investigación es el resultado de 30 años de trabajo por parte del equipo del Dr. Yu Ling.

SEGUNDA FASE HISTORICA: (inglés)

LAKHOVSKY:

Lakhovsky pointed out that all cells capable of reproduction contain in their nuclei "filaments" of highly conductive material surrounded by insulating media. This filament, which may be the RNA-DNA complex, is always in the form of a spiral or helix, in other words, a coil. Therefore, each will react as a tuned circuit if its resonant frequency can be approximated by an external oscillating coil.

Lakhovsky did not carry this to its conclusion; however, I postulate that by exciting the nuclei with electromagnetic energy a "charge" can be induced by the long established principle of electromagnetic induction. This demonstrably raises the energy level and perhaps the vitality of every call in the field simultaneously. Since each cell is an individual, and of slightly different physical dimensions, the exciting wavelengths must be multiple, and must span a broad frequency spectrum. Diathermy machines, limited to crystal-controlled single frequences in the 27.255 MC (Mhz) region, can do nothing but heat the tissue; and yet this approach, abandoned by Lakhovsky in the 1930s, can still be found in "modern" doctors offices!

The electromotive force (emf) produced by the MWO and induced in the cell nucleus, can raise the cell's metabolic rate by electrolysis, and perhaps jog the RNA-DNA "memory" and reproductive capabilities to their level at an earlier, younger age, thus the rejuvenation. Even more subtle changes might be postulated, such as a magnetic "progression" of effects as evidenced by heavy water in magnetic fields.

Perhaps, in **cancer**, the emf induced by the MWO raises the vitality and memory of marginal cells to normal reproduction levels. In the case of other diseases, perhaps cells given higher energy levels can more readily throw off affliction.

The MWO described here radiates a bandwith of radio frequency energy from the audio frequencies up beyond microwave frequencies. By actual measurement with standard field strength meters, this vast bandwidth of frequencies and harmonics can be shown. In fact, a bluish glow of "brush discharge" surrounds the antenna when operating. A fluorescent lamp held anywhere within several feet of the subject glows brilliantly. Within this multiple-wave range of frequencies, every cell in the body can find its ONE resonant frequency and absorb energy at its own natural wavelength.

Obviously the electrostatic energy cannot penetrate the body. This is known as the "skin effect". However, the electromagnetic component of the energy can and does permeate and will induce an emf in each cell. It is precisely this energy to which Lakhovsky attributes his almost miraculous "cures".

Ver artículos originales publicados:

http://www.rexresearch.com/lakhov/lakhusps.htm

En el caso de Lakhovsky, solamente se han obtenido resultados de curación de cáncer de piel, con similitudes a la necrosis aséptica que he observado en casos tratados con el sistema Electro **Cancer** Therapy (ECT).

The complete story: Lakhovsky, Priore, Rife

Literature abounds with detailed case reports of incurable cancers and their unexpected remissions or healings by pulsed or non-pulsed electric fields. They corroborate results achieved by Priore although in a majority of cases, treatment has been given to rather superficial cancers but yet they were as incurable as acute ones, and also of different kinds: **cancer** of the upper respiratory tracts, tongue, skin, breast, uterine cancers.... We are going to review the use, in medicine, of various techniques operating with electricity as well as their results, however minor, and therefrom draw a parallel with the technique used by Priore.

The lessons drawn from researches conducted on the "Priore field", raise great expectations especially when we consider that the results produced through techniques based on medical electricity were of relatively short duration (10/20 mins, with a maximum of one hour per session, twice or thrice a week, sometimes less). And one knows how important can a cumulated duration of exposure be.

The recommended time for a treatment is generally two, three or four hours, or more, daily during the initial phase and a much longer time would be necessary depending on how weak the radiance power level is. Such power, that is the capacity of the machine to polarize significantly the cancerous cells, will not only affect the time appropriate for treatment but also possibilities to eliminate acute and aggressive tumors. There is absolutely no doubt that facilities exist to make fast and easy progress in implementing efficient devices which would allow to apply sessions of short duration (with devices working at very high tension, Priore used to treat everyday, for not more than five to ten minutes, dogs, cats and humans with stunning results).

Moreover, in order to eliminate the tumor, it is essential to go through an immune mechanism and treat the tumor directly, but at the same time, the entire organism needs to be treated to stimulate organs of the reticulo-endothelial system (organs producing immunity cells).

Naturally, in the current situation, such treatment would not be exclusive of other therapies. Yet, extremely careful attention is to be paid to avoid a prolonged weakening of the immune system that could entail failure.

1 - The "radio-cellulo-oscillator" by G. Lakhovsky

In the 1930s, healings of numerous incurable cancers occur by means of a rudimentary equipment, namely a transmitter generating high voltage impulses built by Professor G. LAKHOVSKY and put in operation in big hospitals of France, Italy and Greece. Numerous detailed reports exist (see below).

Without getting into technical aspects, (see Pioneers) we can say that those impulses of powerful energy running repeatedly from ten to a thousand times every second, carry a high frequency wave (one megahertz maximum) characteristics of which must not necessarily be very accurate. An antenna induced with numerous harmonics, is fed by such impulses. As with Priore, we touch here the general concept of shock, high potential, impulse, BF modulation, preferential frequency, etc...

Intrinsic shocks are thus induced at the level of the CELL MEMBRANE hence modifying its polarization of the membrane and by the same token its properties.

Naturally, quite a number of treatments have failed especially on acute tumors hardly accessible to the electric field, and more so because patients are admitted at a terminal stage of the disease, very often on the brink of agony beyond therapeutic recourse of any kind. And also, because the mechanism of biological action was misunderstood: it was believed at that time that those waves were destroying the tumorous cells. Today, thanks to Priore's works, we know that it is a local mechanism with a direct action on the cancerous cell, but particularly the immune one. So, it is necessary to stimulate the defensive system as well, by a treatment of the whole organism. Finally, the need to run the treatment for an adequate period of time was totally ignored. In contrast with PRIORE, studies on the duration of these sessions, their frequency, the cumulated time of treatment, the tumor status from the onset of the treatment, etc. are not available to us. In the meantime, we should stress the fact that the period of exposure, however limited, have allowed such extraordinary results!

No adverse effects have ever been recorded whatever pathology, number and duration of sessions may have been applied to the treatment. These "sessions" last 15 to 20 minutes and are repeated about once or twice a week. We note instant progress in the general condition, and the tumor, when it is superficial, regresses within a few weeks and disappears by a few months, even though the treatment has stopped. The impression is that of a retard effect.

Attempts to improve the results by means of pure continuous waves have all ended in failure (except for **plant cancers**, more sensitive to the least variations of electric field). The main reason was the absence of clear-cut impulses and the tension level used being far too low. For the sake of comparison, it was, in the first instance, equivalent to 100 kilovolts, and one to two thousand maximum in the lamp apparatus.

Let us remind the golden rule : It is not simply a matter of routing energy to the cancerous cell but inducing into its membrane a long-lasting polarization. The cell is sensitive to the electric field only. All the power of a device is meant to supply a powerful field and not to heat. And what about the current set of devices available to us, operating at very low impedance (that is, delivering a large amount of useless power and a minimal electric field)? Besides, Lakhovsky's successors have been able to increase significantly the power by increasing the current, but results were disastrous! All it did was to warm up! Almost a burning process! So, a cause of great exasperation to the "master".

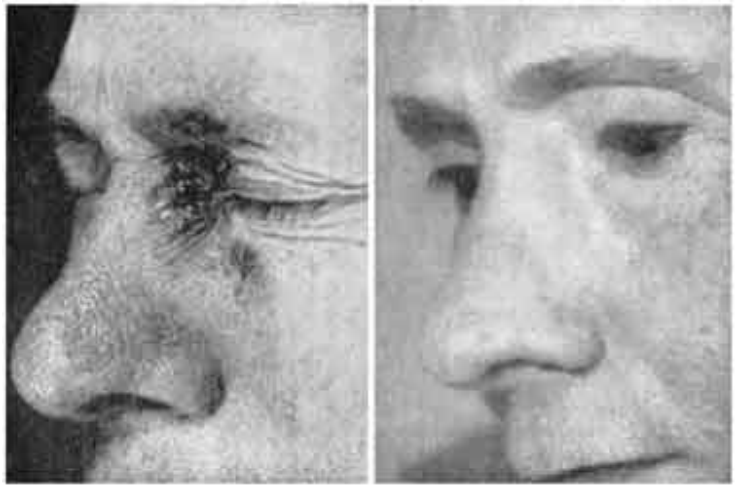
Meanwhile, this heating element is an asset not to be neglected. It enables to slow down the cellular metabolism of the cancerous cell which is much more responsive than a normal cell. This may be a "plus" in a significant way, as it becomes possible to use intense electric fields at a high voltage from which a rise of induced temperature may be derived in addition to the effect of polarization.

Dr. G. Lakhovsky and physicians from La Salpètrière Hospital
Photo de 1932 montrant l'appareil et une des patientes en traitement (cancer de la face)

Lakhovsky : some significant cases

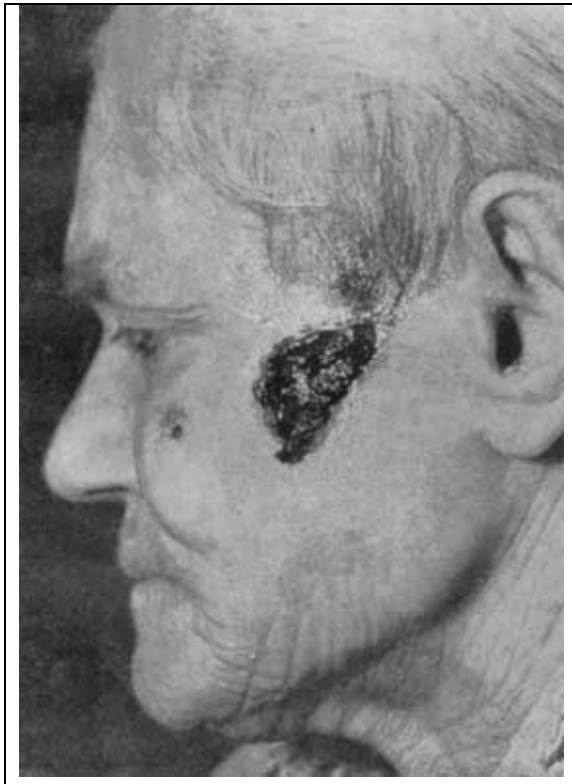
It should be recalled that patients who were entrusted to receive treatment were in such desperate condition that one would rarely expect such astounding results to occur, but still there has been in all cases a regression of the tumor, a remarkable improvement in the general condition and the near disappearance of pains.

Skin cancers (facial)

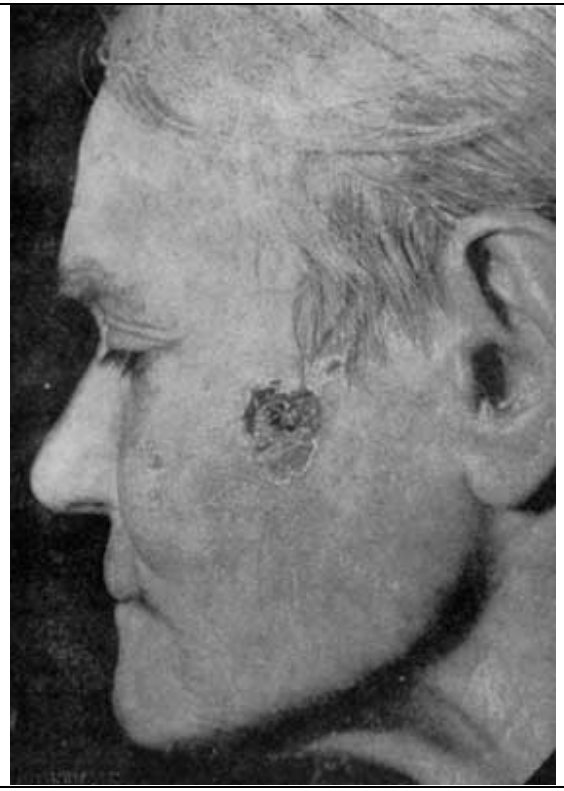


In the internal angle of the eye (spino-cellular) an uneradicable tumor. Before and after treatment: Not only had the tumor totally disappeared but - as with the Priore field - we note a skin perfectly healed and a regeneration of tissues. It was back in 1932 ...!an uneradicable tumor. Before and after treatment: Not only had the tumor totally disappeared but - as with the Priore field - we note a skin perfectly healed and a regeneration of tissues. It was back in 1932 !

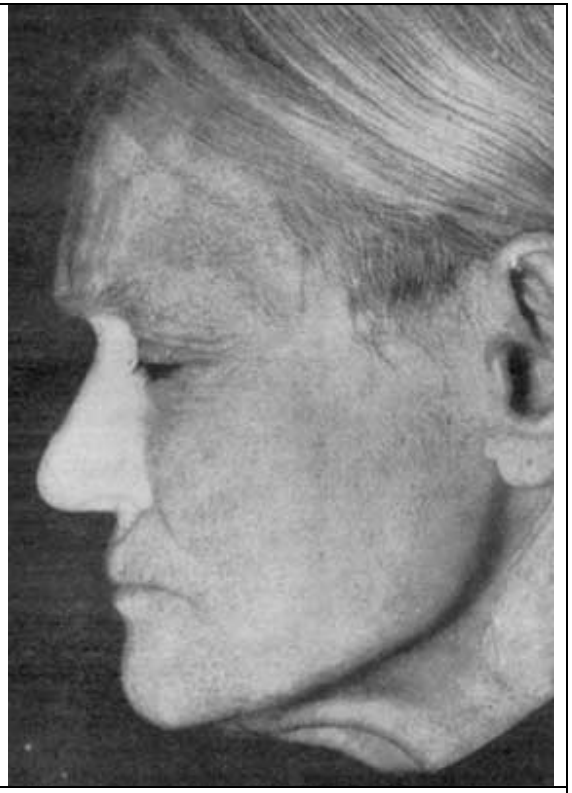
Please observe that ECT images treatments are similar.



Facial cancer

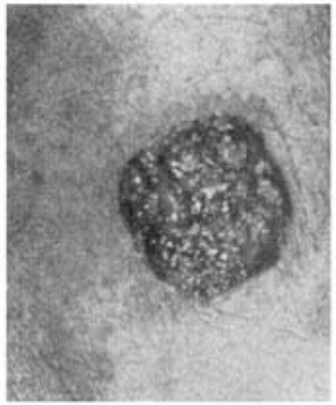


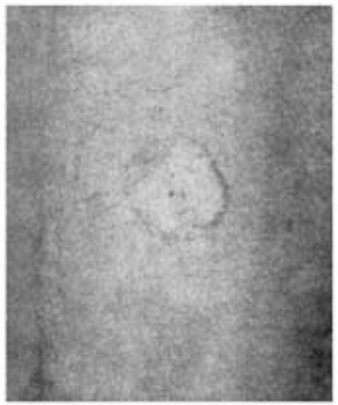
Result after 15 days (2 sessions)



healing within a month

Skin cancers (arm)





No comment!

Other clinical cases

At De la Salpétrière and Val de Grâce hospitals in Paris, years 1931-1932, tens of patients in despair were given treatment, but unfortunately not early enough and not long enough. Some were healed, all of them presented unexpected remissions and considerable pain alleviation.

In a paradoxal way, the treatment may have been deadly sometimes because too efficient: patients showing extreme sensitivity to the waves, get their tumor literally dried up. Unfortunately, the regression speed does not allow feeding vessels the necessary time for a similar speedy resorption. And so, quite a number of patients were lost through much aggravated haemorrhage.

Below, some notable cases of skin cancer.

Example 1 Mrs C..., 68 years old, ulcerated face **cancer** for three years. (biopsy: Epithelioma). A ten-session treatment. Spectacular improvement of general condition from the very first sessions then total Cure.

Example 2 Mr M..., 80, Biopsy: baso-cellular **cancer** of the left arm in fast-developing phase, ganglions. At the end of ten sessions, the tumor has almost disappeared; biopsy, however, shows a discreet persistance under the indurate scar. Treatment unfortunately stopped.

Example 3 Two patients in terminal phase of tongue **cancer** (so, area accessible to waves) with submaxillary adenopathies (ganglions) were in a clearly improved state before being both victims of a devastating haemorrhage at the level of the tumor in resorption process (mechanism has been reviewed). Cases in the same category as the following one:

Example 4 Enormous thoracic tumor (sarcoma?) of ten kilos! Following ten sessions, near disappearance of tumor shrunk to mere scab. Then enormous haemorrhage carrying off the patient, once more by the same mechanism.

The lesson to be drawn from these haemorrhagic thrusts would be to carry out a surgery in order to reduce the tumor as much as possible before the treatment.

The following examples are a selection of remarks gathered in the 1930s from various european hospitals using Lakhovsky's machine.

Healing of an ulcerated breast **cancer** +++, recurrence despite two surgical interventions after ten sessions of treatment (Drs Postma, Groningue, Hollande).

Subject of 60 years old, breast **cancer** recurring on surgical scar. 30 sessions. Almost integral regression and excellent general condition. Dr. Karsis, Athens.

Facial **cancer**: epithelioma of eye internal angle. Recovery after 10 sessions. Three years after, nothing (Pr. de Cigna, Genoa).

Conclusion :

The best results on record relate to cancers which are more accessible to waves particularly skin cancers whether they are primitive or cutaneous metastases of acute cancers, or mouth cancers. It is probable that acute cancers will require longer exposure to more powerful devices.

We could thus continue with more examples of clinical cases but to protesters it will always be no more than a collection of selected observations. And so! It is our hope that the multiplicity of observations showing relief and even cure, will be food for thought. Yet still, there could be objections about certain patients having been subjected previously to customary methods (radiotherapy, surgery). The answer is the following: effectively, it is a matter of treating cancers which have been resistant to normal methods and reduced to terminal phase. Obviously, care has been taken not to include questionable reports in that respect.

And last but but not the least, there is no room for ostracism: if a perfectly supported electric treatment makes it possible, via a stimulation of the immune defences - generally targeted by research teams - to transform the defeat of classical therapeutics into success by combining with them, why be deprived of such facility?

Part of the answer is given by **electroportation**, a technique practised in France and in USA. In the case of cutaneous cancers, it involves the combination of a powerful electric discharge and local chemotherapy. In this way, the cellular permeability to medication is increased, the effect of medicine is thus enhanced and a reduction of its dosage becomes possible. The pulsed electric fields of Priore and Lakhovsky may be viewed as an electroporation which is directed to the entire organ. The difference is, on one hand, the focus on the action of immunity stimulation and on the other hand, the absence of combined chemo. Nothing prevents the perspective of such combination for some selected cases and providing essentially that the immune system is not weakened by the chemotherapy (extremely delicate combination).

Important note :

Although the issue is not strictly based on the use of electric fields, we cannot remain silent about hopes in a possible combination of both therapeutics. In the United States, attempts have been made over the last thirty years, to apply a combination of chemotherapy and microwaves especially on incurable tumors of the oropharyngeal sphere. Amazing and thorough remissions have been observed, unfortunately followed by relapses. On the whole, survival does not seem to have been improved. The reason is quite simple. Microwaves in its application has a heating objective only. In this particular case the technique is completely different and does not at all allow that any significant polarization be carried out on membranes of cancerous cells. The use of high voltage devices is imperative in the process of cell polarization.

Such devices do exist: Radars, they are an obstruction in military surplus stock. Capable of operating at tens of thousands volts and set at a power level that would enable them generate, in addition to their cell polarization capacity, a heating effect to which the cancerous cell is sensitive. Associated with other electric fields, these radars constitute one of the basic components of treatments we advocate... they are fully tried and tested. (Device Building). Its combination with chemotherapy is not an end in itself but could very well be a step halfway between, till finalization of an equipment enabling to treat exclusively by electric fields.

So far, technique by itself opens up the way to great hopes. So, from a technical point of view, we note the following

- No powerful magnetic field is associated with the emission (difference with Priore).

- The machine generates electric impulses of almost similar direction because of a huge absorption by the antenna (Pioneers) and (Device Building).

- These electric impulses are much more effective at high tension (50 to 100 Kilovolts minimal intensity) than medium tension (1600 volts at triodes on lamp devices and continuous waves). In this connection, there is an experiment (Pr Roffo, Buenos Aires, 1932) which consists of placing cultures of cancerous cells into nodes (minimum tension) and antinodes (maximum tension) of the waves. In the latter case, we note a lessening in cancerous growth, and nothing in the other.

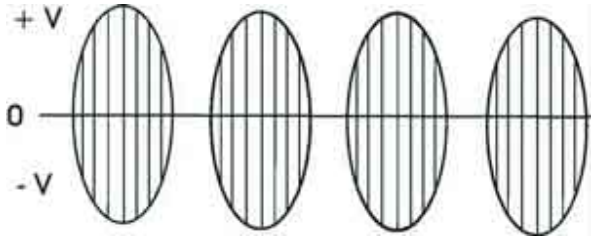
- The frequency of impulses is linked to that of the network or the mechanism of tension rise, i.e. maximum of 100 per second and often less.

- Those impulses carry, in theory, the High Frequency data 0.8 to 1 Megahz (frequency found in some of Priore's initial assemblings). So, because of the absorption already referred to, we may wonder if the impulses carry nothing else but themselves. It may be interesting to check such an assumption as long as we get close to the electric network frequencies of 50/60 hertz.

In addition, the experimental equipment - consisting of production of impulses (+) or (-) at very straight front, some tens of hertz under very high tension - can be easily built for specialized labs (EDF: Central Electricity company in France). Devices of similar type are being used already in researches on sterilization (farm-produced industry).

2 - Cancerologic effects of pulsed high-frequency waves

This refers to a high-frequency transmission supported by 27.12 mhz (standard frequency requirement for industrial and medical equipment) and low frequency pulses of 80 to 600 times per second. So, the average power which is transmitted goes up to a maximum of tens of watts - quite an inadequate level to generate a heating effect. The most famous of these machines is called Diapulse*. It operates at 1500 volts, thus generating electric fields very much higher than transistorized devices and operatiing at low tension. It is indicated mainly for rhumatology and inflammatory phenomena.



Aspect of the transmission: symmetrical High Frequency impulses

It did not take long to realize that a process of stimulation of the immune defense mechanisms existed and that its indications have been extended to warts, acne, chronic infections (cutaneous staphylococi, sinusitis +++, etc). Some physicians tried to find out if such immunity stimulation could be of use to cancerology. Notwithstanding a lack of approval, a certain number of patients suffering from incurable cancers have been treated with noticeable results concerning their general condition, pain and survival status. Treatment sessions were scheduled every day for an average of 20 minutes.

Below some examples selected by Dr Marcel (private surgery) and Dr Besombes (1972, De Coulommiers Hospital -France).

Mr G. 55 years old, patient with tongue **cancer**: Surgery + cobalt. Terminal phase. No food. Opiate medication. At the end of ten sessions approximately, started to take food again and refrained from opiate. However, disease in soft progress leading to death three months later.

Mrs B... **cancer** with lumbar metastases. Terrible pains. Major antalgics, morphine. Two treatments per day. Three weeks later, in spite of **cancer** development, takes aspirin only.

Mrs P... abdominal invasion by unoperable uterine **cancer**. Life expectancy from two to three months. Treatment everyday. Extraordinary results on general condition. Tumor growth stopped. Patient back to normal life 15 months later. Thinking she had safely recovered, she stopped the treatment she considered too constraining. Relapse the following weeks and decease.

Mrs O.. Kidney tumor+++ (very aggressive tumor, invasion point). Nephrectomy only. Pulsed waves on daily basis, then twice/thrice weekly. 18 months later, no sign of recurrence!

Similar cases are numerous. The effectiveness of the treatment depends on factors specific to each individual, to the status of the tumor, its localization. Yet, there is an element which is common to each of the above observations. It is the remarkable antalgic and anti-inflammatory effect, a complement to the anti-cancerous effects.

Conclusion :

It is unlikely that this technique on its own could produce a great number of successful results, especially in the case of much advanced cancers. There could hopefully be a slight improvement in terms of results by using devices which perform with much higher tension, tens of kilovolts and somehow different frequencies. And this, still for

the same reason: It is not a question of transfering power but rather inducing by electric fields a persistent cellular polarization. Such devices exist in the form of radio station transmitters working with lamps. A technique still in force in the case of powerful transmitters.

Especially, it appears that the Low Frequency (80 to 600 hertz) "coating" of the signal is superior to the High Frequency it carries. Therefore we are confronted once more with the question about Lakhovsky's devices: Is the LF/HT feature a predominant one? There again, it seems interesting +++ to study the biological effects of impulses (+) or (-) at very high tension (see above).

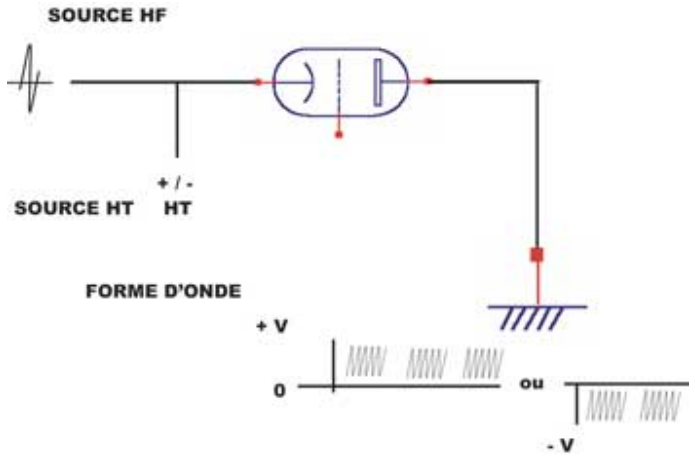
Roy. Rife's pulsed high frequency

Briefly, it is a technique which differs from the previous one in terms of tension levels used and impulse emissions being constantly (+) ou constantly (-).Briefly, it is a technique which differs from the previous one in terms of tension levels used and impulse emissions being constantly (+) ou constantly (-).

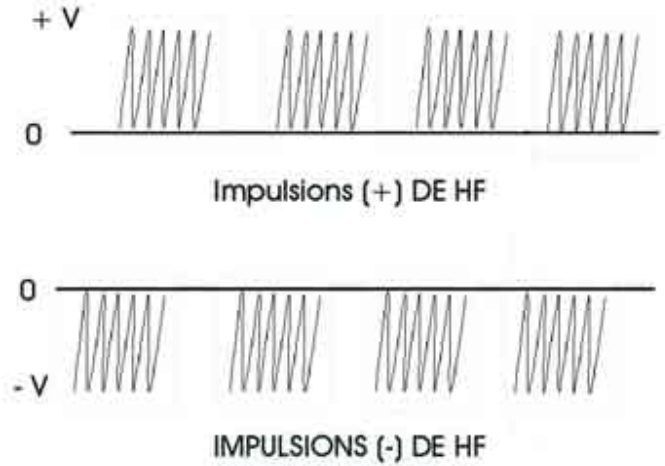
The case of Dr Roy Rife is controversial. There has been some reticence to mention him since his ideas appear to have diverged to mercantilism. Besides, his researches and methods being misunderstood, have given way to paranoiac and frenzied attitudes from anti-medicine supporters and universal plotters against unrecognized genii. Whatever the case, it is in the 20s/30s that he finalized a machine meant to rid cancerous cells of inclusions which, he believed, were viruses causing the disease, in order to restore the cells back to a normal state.

It is a complex transmitter which, at low frequency, generates impulses of high frequency at very high tension; such impulses being (+) or (-) on account of the superposed position of the continuous field. The whole is carried into a large neon bulb which distributes the composite electric field.

Hereunder, an example of diagram and appearance of resulting electric impulses.



The treatment bulb contains neon. It radiates an electric field created by **HF impulses (about 11.8 or 23.6 mhz) superimposed to a constantly positive or constantly negative field. Therefore there is never inversion of the latter. The whole being pulsed at low frequency and very straight front.**



Appearance of impulses on Rife's apparatus

That American practitioner has been a victim of harassment - undeniably - hence, evoking the legend of an "Establishment" plot as generally advocated by inventors yearning for recognition. It is nonetheless true that, being particularly prolific and rigorous, he had, like Priore, established the construction of his equipment probably on the basis of erroneous hypotheses, which equipment has been successful in treating and sometimes healing incurable diseases. This can be evidenced by various physicians who have used his equipment.

1932 was the time of success for Lakhovsky at De la Salpétrière Hospital. A study of his equipment revealed quite a number of astonishing similarities with Rife's apparatus. 1932, extraordinary coincidence as both men are unknown to each other, and it is also the year when a series of sixteen patients suffering **cancer** in terminal phase, are treated by R. Rife. These patients were chosen by a committee of doctors for their desperate condition and treated under the committee's supervision three minutes every day (which appears extremely short). Three months later, fourteen of them were declared clinically cured by a committee of five doctors!!! Neck cancers, stomach cancers as big as oranges had totally disappeared! During the following years, more victories over cancers, tuberculosis, ulcers etc. were obtained (we find here conventional indications of pulsed electromagnetic waves). As for Rife, all he got from these extraordinary events was... a lawsuit which led to his downfall (see JP Lentin's well documented piece of work "Ces ondes qui tuent et qui soignent" meaning Waves that kill and heal - Ed. Albin Michel).

Although too good and hard to believe, this is a story with testimonials from numerous witnesses among whom, doctors who participated in the treatments. From the viewpoint of authorities concerned, the cause of grievance is the usual one: the experiments have not been conducted in accordance with standard statistical rules. Was there an alternative?

We ourselves would not have mentioned that story as it sounds so incredible. Such a high percentage rate of success is unbelievable! But the reference was deemed useful following a detailed study of the equipment whose concept revealed characteristic similarities with those of Lakhovsky and Priore (twenty years later) at a time when they ignored each other's existence. Common traits are to be found in their respective destiny as well. All three realized astounding results, had to face the hostility of the scientific community, died in abandonment just the same way. In short, the three of them were relentless experimenters more concerned about improving their achievements than establishing a concept.

The hostility expressed by a majority of the medical corps is understandable considering that behind the scenes of cancerology, numerous crankies of all sorts are busy advocating, in the name of a self-declared truth, the rejection of proven therapeutics. Even so when they are not prompted by mercantilism. So far, they have contributed to no advancement at all. Furthermore, we need to admit that it is not easy to readily accept that some isolated individuals, pathetically equipped and acting off their own bat, have come to success where highly prominent men have failed. Yet, it is regretful that such a tiny group of physicians came to be puzzled by those results beyond expectation.

3 - Healings by constant regulated flow of current (ionocinesis) : once more a matter of polarization

It is a simple technique (too simple?) and extraordinarily effective on certain types of tumor. The everlasting problem is, of course, the need to apply it at a relatively early stage. Given the circumstances today, one must obviously choose proven therapeutics in compliance with the "usual" treatments for cancers. Cases may however arise when cancers have grown beyond the level of conventional treating methodologies, for instance, at the end of their evolution, in the case of aggressive skin cancers at early dissemination, or when treating an elderly patient, and even early cancers for which clearly defined guidelines are lacking (case of prostate cancers beginning to grow).

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At least, there could be, in addition to conventional methods of treating inexorably condemned relapses (just think about the multitude of breast **cancer** recurrences at pre-metastasis stage), another type of treatment which is perfectly supported and operates at low cost. Are currently known to us, absolutely inexplicable recovery cases (hepatic metastases of digestive **cancer**) of patients applying this technique on a daily basis. However, in the light of the current legislation, it is advisable to be very cautious, even when acting on compassionate grounds given the very stringent laws of ethics.

One of the greatest advocates and user of this method has been, 15 years ago, the Swedish Professor B. Nordenström, at that time Chairman of the Nobel Prize Committee, who can pride himself on excellent results in his department at Karolinska Hospital in Stockholm. He established a complex theory on power circulation within the organism using a percutaneous electrode which penetrates the tumor by its connection to a generator operating under ten volts approximately. The other electrode is applied at a distance upon the skin. The device is kept in place for about ten days and entails a local change in the ionic atmosphere of the cells, hence in the polarization of their membrane.

Results : Out of 26 patients suffering from incurable lung **cancer**, 50% are still alive six years later! In spite of such evidence, the technique not in common use in cancerology, has been denied recognition mainly through a lack of understanding of its operating mode (?) alas! To our knowledge, it is back in use by the Chinese. Yet again, it should be pointed out that better results would have been achieved had the cancers been subjected to treatment at an earlier stage of their evolution and also technically, if the voltage applied had been much more important and the treatment time extended. To achieve this goal, we may focus our attention onto the electroporation techniques described above.

In Paris, France, Professor Bader, Director-to-be of INSERM (medicalwise, the National Centre for Scientific Research - CNRS), came to realize in his department at H. Mondor Hospital in Créteil, sensational regression and pain alleviation of tongue cancers by using a technique of "negativation", a legacy of veterinary experimentations. It involves a local application of negative electric charges provided by a small generator. His professional responsibilities prevented him from carrying on endeavors in that promising direction.

In Bordeaux, a city particularly endowed with prolific researchers, it was in a more discreet manner that Dr J. Janet regularly achieved absolutely fabulous results. He has been using for the past 30 years - taking us back in time - an apparatus that delivers at some tens of volts a power which has the distinctiveness of being constant and regulate. He named his technique "Ionocinesis". The power is used alone. It carries up to the tumor some very effective ionizable anticancerous medication whose usage via normal routes is restricted due to its toxicity. By this mode, all the "benefits" go to the tumor, rendering the use of such medication possible.

He had a rather contant trend of successful realizations improving the general condition of cancerous patients under his care and alleviating their pains. Together with his trainee students, he has obtained wonderful victories over incurable cancers. He quotes documentated observations of several cases of incurable cerebral cancers among children or hepatic metastases of cancers in terminal phase (cf. Thesis by Dr D. Moulinier, trained by Dr Janet, Faculty of Medicine of Bordeaux, 1984). Some examples are outlined below.

Ph. D.., ten years old: Femur osteosarcoma (bone **cancer**). Surgery impossible. Immobilization. Radiotherapy and pseudarthrosis (lack of consolidation of **cancer** localization). Cured after a few months treatment.

Mrs P..: Highly developed uterine **cancer** expanded to abdomen, inoperable. At the end of twenty sessions, remarkable regression of the tumor, a major part of which could thus be removed by surgery. A microscopical examination of the operative segment revealed a blockage of mitoses meaning that the cancerous cells are not killed but their multiplication has stopped, so allowing the immune defenses time to work - more so, considering they are stimulated by the electric field. In any case, the **cancer** at its point of dissemination would not have been eradicated by surgery only. Yet, this patient will be cured.

Mrs B..: Foot nevocarcinoma (highly malignant degeneration of mole). A **cancer** of the most fearful type. Its progression is devastating. Large darkish metastases spreading over the whole of the lower limb. Failure of all therapeutics. Following treatment, total disappearance of masses, and healing.

Dr Mouliner's thesis on Ionocinesis illustrates quite a number of results and examples. Reference is made to a young boy suffering from an epiphytic tumor, another from a cerebral tumor at paralysis point, and other types of cancers: breast, colon, uterus, prostate, etc...

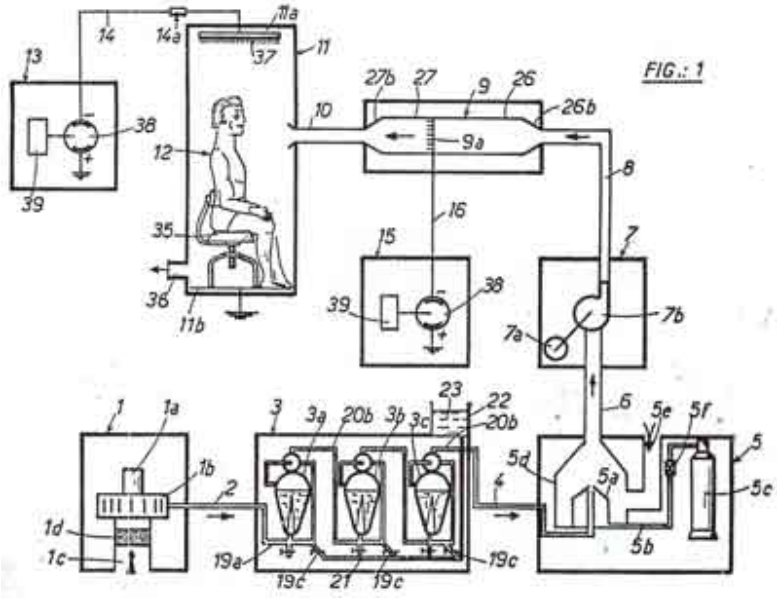
4 - Other electric polarization technics: inotherapy and static electricity

We will shun the untimely and controversial subject of chemical treatments directed at modifying the polarization of the membrane. It concerns in particular various tensio-active elements (soaps) whose purpose in veterinary medicine (IV or IM injections) has shown positive results in different degenerative diseases; it is for instance the case of a detergent (!) : The "EPEG" - ester of polyethylene glycol.

There are some electrical techniques with much less assertive results than what has been outlined so far. Yet, we are going to refer to them because their action is also based on an alteration of the membrane polarization. Our interest lies on the absence of High Frequency electric fields which are replaced by an outward source of electricity and significant static fields. As a matter of fact, Priore constructed a "cabin" that has been patented. There, he draws his inspiration from the works of another Frenchman, R. Jaquier, as well as from Russian doctors. This proves that High Frequency electric fields are a means among others and that there is no dogma, no magical mixture of radioelectric frequencies. Priore's obsession was effectively a polarization of the cell whatever be the procedure applied.

With this device it is possible to fix negative electric charges (positive ones cause disease aggravation as polarization is effected the reverse way) on enormous molecules of terpene (say terebinthine) by making them go through an intensive electric field. These polarized molecules are inhaled in the form of vapors by the subject and transmit their charges to the tissues they come in contact with. Priore brings a final touch to this mechanism, presenting a cabin in which the subject, in connection with the earth, is exposed to an electrostatic field of several tens of thousands of volts to enable him keep those charges as long as possible. He was therefore able to obtain interesting results, though much less than those he realized with his transmitters. Like Jaquier, he achieved with this method pretty good results in cancers being in contact with the electric flow: mouth, tongue, palate, tonsil, larynx, lung etc. He has always obtained pain sedation, often unexpected remission, sometimes cancers in desperate condition could be declared cured.

5 - Healings by Priore



Priore's Patent for a cabin of static field and electricity loaded terpenes Tension up to 80 Kilovolts !

The subject is vast and a brief outline of the results on man will not meet our purpose. Of course, it is neither a statistical survey based on standard criteria, but rather a collection of success stories compiled for the sake of making people, even among the most sceptical, question themselves. Besides, there is evidence of cure in specific cases where biopsies have been conducted before and after treatment.

It must be recalled that the cure is absolutely indisputable and is replicable on mice of 20 grams affected with incurable cancers, on rats of 250 grams, and on cats and big rabbits weighing several kilos. The latter will therefore correspond to the weight of a new-born child and such a possibility by itself opens up to fantastic hopes since the treatment parameters are more or less the same for man and animals.

Naturally, healings among grown-ups are not systematic. Priore knew the reason why. The number of healings would have been countless if the great majority of patients calling for treatment had not been desperate cases, often in terminal phase; even at that point, if only the power of the equipment available to him had been commensurate with the weight of the body to treat (70 kgs for an adult compared to a cat of a few kilos, or a mouse of 20 grams, we need to multiply the power by 25 in one case, and by 300 in the other). Hence, we come to his last machine, the tremendous M600.



Due to restricted means, Priore was deprived of facilities to raise the power level of his devices. So, he opted for clever and complex adjustments in order to increase their productivity. Improvements of minor importance but so invading that the majority of observers were brought to believe mistakenly that they had an essential role in the process.

Moreover, it should be noted that all the scientists - indeed, the totality of them - who conducted major studies on Priore's works, and in particular a large number of biologists, doctors, university physicists, his day-to-day collaborators, were staggered and enthused by the quality and importance of the outcomes. Some did not hesitate to stand up and face hierarchical opposition, risking the label of "gullible fools". And one knows how disastrous it is to open oneself to ridicule in university circles.

Unhesitatingly, are outlined below some examples of "gullible fools" !! Be the judge:

- Gullible fool R. Pautrizel, Professor of Immunology, the best in France in his special field, WHO expert, he will give ten years of his life to show the immune mechanism of radiation. In lieu of reward, he will be deprived of his laboratory!

- Gullible fool Professor R. Courrier, reputable cancerologist, Chairman of the Science Academy, keen advocate of Priore, he used to work personally on the transplant of tumors and presented several papers to his assembly.

- Gullible fools - Renowned cancerologists who conducted the entire experimental work on the equipment. Cancerologists from Bordeaux (Pr Delmon, Pr Biraben), Paris cancerologists (Pr M. Guérin, Pr M. R. Rivière who will dedicate two full years to cancerology work in Priore's laboratory), cancerologists from the most famous anti-**cancer** Institute in England (Pr Haddow, Pr Ambrose).

- Another crowd of Gullible fools, all professors of Medicine at the Faculty of Bordeaux. Irrespective of any order, we quote G. Mayer who conducts histology studies on treated animals, Cambar, Dean of the Faculty of Pharmacy: he heads the medical commission in charge of validating experiments (with certified report! we've come to such an extent!).

- Discreet Gullible fool but not anonymous J. Bader, Professor of Medicine, influential expert and Director of INSERM - the prestigious national organization of medical research in France, he heads and coordinates the work of thousands of top researchers. He will be at work unflaggingly and in all discretion for the construction of the devices. He is currently supervising the works conducted by an important university team in Bordeaux - Out of an inclination for ridicule?

- Gullible also, a certain G. Courty, re-elected by his peers in medicine President of the "Conseil de l'ordre d'Aquitaine", an organization full of gullible fools as you may guess!! Professor Courty, together with Professor Dubourg, celebrity of surgery in Bordeaux, has wilfully published a study outlining spectacular clinical progress (tumor and adenopathies thawing, pains, general condition) and the biological betterment of about fifteen sick persons suffering cancers at terminal or outgrown point. Yet again, those physicians were in a position to present unexpected remissions and inexplicable healings.

- Last famous Gullible fool, A. Lwoff, one of the "fathers" of DNA theory, Nobel Prize of Medicine. Following an unbiased study of results, he will be one of the most ardent supporters of Priore, to the extent of claiming the construction of a machine in the prestigious anticancerous Centre of Villejuif in Paris; failing this realization, he will experiment in the very laboratory of Priore on the latter's ultimate device.

We are not yet close to the end of the listing... Beside the medical corps, the scientific, political and industrial world respectively are not outdone:

- Astonishing Gullible fool: J. Chaban-Delmas, Mayor of Bordeaux, Prime Minister, National political leader. Publicly and unceasingly supporter of Priore, the latter's apparatus was inaugurated by him; he used his authority to fight opposition from top officials concerning a funding allocation to the inventor. Overtly risking his career by some scandal about "Government funds to support quack" (the press would be merciless).

- Another assembly of Gullible fools: The Regional Council of Aquitaine. By unanimous vote of members, of all political leanings (whereas confrontation never ends in this assembly), approval to allocate two million francs just after Priore's death, in order to carry on the latter's works within the University.

- Still more incredible Gullible fool if ever possible, the firm Leroy-Somer, huge industry for the construction of electrical equipment, becomes Priore's associate and injects in this adventure an investment of ten million francs (1.5 million euros).

- Physicists are Gullible fools as everybody knows. Especially when they are lecturers at the Faculty, or government experts, and exert themselves to mobilize research in universities in order to fulfil the whims of Priore... Surely this must be the reason for their relentless efforts to understand and reproduce "The Machine", in Priore's time already, and also after his death. They carry on with the work, still.

- A special note with regard to the State Secretary for Research, other Gullible fool called J. Joussaut-Dubien, scientist of high calibre who mobilized his staff to finance non-official university researches on the Priore Effect. Still today, though in retirement, he maintains passionate ties with the advancement of these works.

- Well-known nest of Gullible fools: the Military Research departments have been active in their collaboration to the measurements of the machine and... **Attempted a reconstruction of it for tehir own use (D.R.M.E. confidential report).**

- The comprehensive list of Gullible fools will end with the C.E.A. (Commission of Atomic Energy). The CEA will place in secondment one of its most brilliant engineers and use its influence and enormous technical resources for several years, to participate in the secret construction project of a Priore apparatus at the University (it is in operation today without results). This was only a few years ago. They are so much naive at the CEA that some Gullible fools were still pursuing their efforts, fifteen years after Priore's death.

In short , among the sceptical, the great assailants of Priore, none of them actually worked on the subject!!! Nice illustration of Cartesianism and incisive judgment, yet so common throughout the history of revolutionary discoveries.

And finally, why trying to treat with contempt the opinion formed by hundreds of ill people, placed in a situation where medicine appeared to have been at the bottom end of its resources, and who unexpectedly found remission, annihilation of their sufferance and even sometimes, miraculous healing?

Once again, it is possible to understand the reticence of a large number of doctors who must deal with the terrible agony of their patients, to readily accept that a man, destitute and all by himself, could have succeeded where so many distinguished teams of researchers have failed. Moreover, so many times they have been confronted

with quacks of all sorts, those whose reputation or good fortune are made out of an anti-medicine dogma. Those who speculate on the last hopes of people suffering from this incurable disease. However, our perplexity is more about the lack of intellectual curiosity from a few. After all, the information might not have been to the level of the discovery.

Back to healings, we must say that they are numerous and directed to a wide range of diversified pathologies that go beyond the cancerology field to integrate a rather vast sphere, that of the organism restoration system.

A law of "Self Preservation" does exist. It is the law of any living organism aiming at its safe keeping, in the best possible condition, as long as possible, protecting itself against any attack, any external or internal risk. It is therefore actuated to eliminate anything that does not belong to its true nature because a threat to its survival. Such a function is assigned to the immune system. Hence, begin the struggle and destruction process against all bacteries, viruses, foreign bodies but also, against any cell that does not conform, be it foreign (in the case of blood group or organ implant), unhealthy (cancerous cell), or sometimes simply a modified cell.

This immune system integrates itself and operates along with a more integral system of cell restoration targeted at the preservation of the organism integrity, a kind of permanent struggle against degradation, ageing and death. This restoration system seems to overpower the previous one in order to get the survival operation on track. From a biological point of view, it is equivalent to reflexes and psychological attitudes of what is called "survival instinct". This explains the closing up of a wound, a trifle in everyday life but an amazingly complicated process and no wonder a liver almost totally destroyed by hepatitis regenerates integrally (please note that some species are capable of regenerating a full limb, which is not more complicated than the liver, and that the human DNA has been able to keep the hidden memory of such mechanism).

These considerations give an explanation about various aspects of action by the "Priore fields" in a wide range of pathologies. All go as if it were a stimulation - or a collapse - of capacities of the conservation/restoration system and the cancerologic effects of which are not more than an application.

Effectively, in addition to results in **cancer** and infectious diseases, Priore can present successful achievements in areas as varied as rhumatology, bone tuberculosis, scar forming, pain abolition, normalization and collapse of excessive cholesterol levels (paper to the Science Academy), regeneration of organs, not genetically formed for such action (rabbit testicles, another paper to the Science Academy) as well as in various severe degenerative pathologies such as multiple sclerosis.

We are conscious that such a listing can be evocative to all those who have fallen a victim to the numerous quacks of **cancer** and other incurable diseases boasting about the miraculous proprieties of their methods and universal panacea. Yet that's how it is. By stimulating the restoration and preservation systems, the "field" permits to effect improvements in a wide variety of areas where **cancer**, as mentioned earlier, is only an illustration

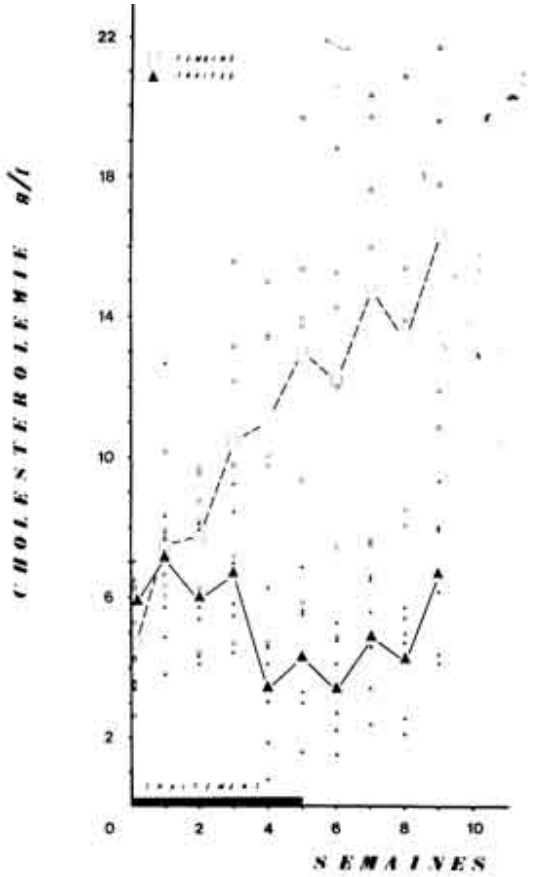
Example : Before, we were totally unaware of the immunological nature of multiple sclerosis. Now it is known that it comes from a destruction of nerves by antibodies the organism manufactures against itself. The liability of a viral infection on a genetically predisposed organism is more than probable. This immunological element is the explanation to Priore's unexpected successes against the disease when we establish a relation with the radiance action mechanism.

Another very significant example : Normalization of cholesterol level. Although the study has not been conducted on a human being, it is referred to on the basis of outstanding similarities.

Experiments take place in an experimental lab (INSERM unit) at the Faculty of Medicine of Bordeaux under the supervision of cardiologists among the best from hospitals.

Rabbits fed exclusively on fat are shown with an excessive level of cholesterol. Under radiance action, this level gets far below that of a normal animal. The lowering effect is maintained several weeks after treatment has stopped and despite a high cholesterol diet. Results are confirmed by the sacrificing and examination of the big arteries which indicate a regression of atheroma blotches (vessels are obstructed by them) formed by hypercholesterolemia! As outlined in a Paper to the Science Academy (C.R.A.S. dated 20/12/71 tome 274, pp488-491, 17/01/72).see Bibliography

At that time, as in the case of multiple sclerosis, the role played by immunity was unknown, particularly the cell immunity which is called macrophage in the regulation of these blotches (the way a sanitation man operates).



Increased level of cholesterol in a rabbit on fat diet, with or without treatment

It must be acknowledged, therefore, that the organism is endowed with unsuspected resources, and to intervene in this particular line opens up onto fantastic therapeutic perspectives. It takes no more than a review of initial results in the use of "root cells" capable eventually of regenerating any type of organ. Only ten years ago, the mere allusion to their possible existence outward certain organs, or mentioning their extraordinary potential, would be enough to have any Med student expelled from the Faculty. Meanwhile, a study on root cells and their properties had been described by a well-known American researcher, Dr Becker, who was persecuted for having been right, too soon.

In the field of **cancer** itself, a distinction is to be made between (a) results that Priore obtained on animal cancers and which were constant, replicable and carried out under the direct supervision of biologists and physicians, and (b) his successes on humans, failing to meet the standards of methodology practised in that field. For instance, there is no double blind experimentation, nor any statistical argument.

The accumulation of results, unexpected remission of cancers in terminal phase, authentified healings based on pre and post treatment biopsies (several examples will be produced), considerable soothing or disappearance of pains, constant improvement in general condition, systematic relapse after remission in case of premature interruption of treatment, unanimous testimonials of satisfaction, all of the above form the basis of argumentation. And yet, what forceful arguments!

Let us recall, one last time, that Priore was solicited generally when all other therapeutics had been exhausted, "just in case", and at a dramatic point of the disease. Patients were found in so severe condition that there was barely any hope. The inventor was not fond of therapeutic archives, having a preference for treatments. In addition, medical files were the property of either the hospital or doctors, and so were rarely directed to Priore who, besides, was not at all bothered by such a situation. However, several cases of healings supported by biopsies (microscopical exams) can be withdrawn from the archives. According to Professor Pautrizel, physician of great integrity, there are tens, indeed thousands of dossiers of the sort.

As a first example, the case of Gaston R. In 1955 the microscopic analysis report of a biopsy of the larynx is formal: Epithelioma (Dr Biraben, Report No. 72741 of March 10, 1955). It is a laryngeal **cancer** at initial stage. The patient refuses surgery in order to receive the "Priore treatment" during two months. New biopsy: mere hyperplasia, which means a benign cell anomaly (the difference is the same between a hyperplasia of the uterine mucous membrane which is cured by hormonal treatment, and a uterine **cancer** with therapeutic results easy to guess), but in no case a **cancer**. In other words, the treatment has transformed a cell affected with **cancer** into a healthy cell to watch. A slight variation but a big difference: in one case, there is **cancer**, in the other, none.

Besides, all the elements in this matter and particularly the microscopical veterinary observations reveal that the Priore field permits, at an early stage of the disease, a "neoplasic reversibility" of the cancerous cells. Which means, as noted as early as 1960 by physicians of the anticancerous centre in Bordeaux, that "everything goes as if those cells had lost their cancerous characteristics. In some way they are back to normal, and if, for the immune system, they are not, it will work at their elimination."

N.B. : This phenomenon of neoplasic reversion is found in therapeutics of some types of leukemia where monstrous leukocytes (white corpuscles) come back to normal size by the action of certain medicine.

The second example is dated 1954. It concerns a 12 year old boy, Alain B. Conclusion of the microscopic analysis of samples: malignant reticulo-sarcoma. All doctors know that it is a death warrant in the very short term. A dreadful **cancer** of the lymphatic system (c.r. No. 1322421, Dr Angibeau, Saintes Hospital, Charente). In spite of this awful verdict, the teenager benefiting from the Priore treatment, will be totally and definitely cured from this terrible disease to the extent of receiving from his doctor, twelve years later in 1966, a certificate confirming the absence of chronic illness (Dr J. Moulinier).

The third example - and it will be the last - comes from Professor G. Courty, Chairman-to-be of the Regional Council of Aquitaine (Ordre des Médecins), Head of the Pneumology Department, physician of integrity and hardly likely to be suspected of collusion. He strongly believes that Priore, maybe by chance, has come across something very important and with the courage of his convictions makes a declaration thereon in the media.

With a stronger will, he publishes along with Pr. Dubourg, the Bordeaux referent as far as surgery is concerned, a study about a dozen cases, the majority from his department. It must be pointed out that it was quite exceptional to make such a move in the medical and university environment where permanent judgment on peers and the medical ethics impose extreme precaution and the observance of stringent lines of action. Risking to irremediably compromise his career, he addresses a report to the Science Academy, on case studies of a dozen patients, all of them presenting inoperable, incurable, terminal cancers.

The first seven cases deal with lung cancers. There is confirmation of a systematic improvement of the general condition, which doctors consider outstanding. The patients start eating heartily, are back in strength and on foot, feeling no more pain.There was simultaneously an improvement of the V.S. (witness test of the organism inflammatory level) and of the N.F. (test to determine anaemia associated to cancers). They are able to receive treatment one hour only per day (very much insufficient at this stage) and will die peacefully.

The following are even more puzzling cases especially being incurable ones.

- Mr T. - Inoperable and advanced lung **cancer**: Discreet chemo uneffective on tumor (this treatment alone has never cured such a **cancer** at that level). The "Priore treatment" is applied several hours daily. Results by the eighth month: Thawing of mediastinal adenopathies (enormous masses of ganglion tied up to the **cancer** causing rapid death by suffocation, and killing even more rapidly than the tumor). Twenty months later, that patient who was lost is living very comfortably despite his slow-growing tumor.

- Mrs T. - Had surgery in 1977 for brain tumor recurrence: Confirmed by biopsy (astrocytoma meaning a dreadful tumor, totally incurable). Attempts to slow down its evolution by chemo and radiotherapy. Total failure. In February 1978, faced with the imminent fatal outcome, "Priore treatment". About two years later (the document is drafted in December 1979), this patient considered lost is still alive!

- Mrs D. - Advanced rectal **cancer**: Objects to traditional treatments. **Cancer** reducing by half with "Priore treatment". Relapse with fast aggravation during a three-week breakdown.

- Mrs D. - Inoperable vaginal **cancer**: Expanding to the bladder. Shrunk by half after five weeks of "Priore treatment". Considerable improvement of general condition. Despite everything, resumption of tumoral development after three months. The treatment, like the lung **cancer** cases mentioned above, will do no more than putting off the fatal date yet permitting a much better comfort.

- Mrs P. - Very adhering rectal **cancer**, Refusing surgery, she is condemned. In spite of a palliative radiotheraphy (by which healing a **cancer** at such point is absolutely impossible), tumor aggravation. We are in 1977."Priore treatment" everyday during nine months. Complete disappearance of tumor. Several negative biopsies in 1979. Doctors conclusion: HEALING.

Those few cases are far from being the most illustrative. Furthermore, they are all about overgrown cancers. Let us just think about what could - and what would - have been done, had the cancers been much less advanced (besides it is not at all prohibited to associate with other conventional treatments the "Priore treatment" which appears to be a strengthening tool. See chapter below). We have chosen to report on them because they come from highly qualified university sources and the mere fact that physicians of that level commit themselves tells a good deal about all the seriousness and importance of Priore's results.

Our final word will be the conclusion of this prominent medical team :

"We are fully convinced that it is an innovative scientific method against cancer"

6 - How the "Priore treatment" positions itself beside conventional therapeutics

How to define this position? Probably, the day we will have at our disposal a powerful and reliable equipment capable of reducing the duration time and the number of sessions, most of the current therapeutic indications of cancers and severe degenerative diseases will go obsolete. While we look forward to that blessed moment, the "Priore fields" indications may be summarized as follows:

A - Treatment of precancerous lesions, simultaneously with preventive measures or conventional medicines. Let us take a few examples :

First exemple : Oesophagus, Stomach.

Some pathological situations, in particular excessive alcohol, bad teeth, chronic stress, hiatal hernia (the stomach, distorted, allows its acidity protrude through the oesophagus which cannot bear it), etc. cause an inflammation of the oesophagus, hence a predisposition to an extremely serious type of **cancer**. Of course, we can try to remove the activating element(s) of the disease but even then, it is sometimes too late to check its evolution. The oesophagus has not yet turned cancerous but we know it would start to be so whatever we may do. So, we merely keep watching over regularly in order to be able to undertake surgery from the very early signs of **cancer** (the operation involves much mutilating, endured with great difficulty and rather ineffective. It is performed under constraint and obligation).

The "Priore field" may find here an excellent indication because its action is particularly effective at the beginning of cancers, and still more at the time the cell switches from a precancerous anomaly state to a cancerous one. It seems to act by modifying the conditions and the electric environment at cell membranes level. In one way or another, it brings them to "stabilize", and also allows the immune system to eliminate cells which are too abnormal. Consequently, it has been possible to observe from various animal biopsies and on man that cancerous cells have been transformed into normal ones without being destroyed. This is called phenomenon of neoplasic reversion.

The Priore fields induces a neoplasic reversion

- Mode of application : A treatment by external fields is conceivable including regular prescription of several irradiations, or even to have, at renewable predetermined intervals, an esophageal probe permanently in place for the required treating time. It is then an internal irradiation, in contact with the diseased mucous membrane.

Naturally, other remedial considerations as number of sessions, treatment duration, repeated cure over time, are to be studied in a similar enthralling manner.

Second example: Skin and Mucous membranes precancerous conditions:

Let us take for example certain precancerous lesions of the face, mouth or vaginal mucous membrane presenting a serious risk to degenerescence into genuine **cancer**. Surgical or cauterized extermination are not always feasible and relapses are the standard rule. There is no effective medicine. Sometimes the only attitude that one is left with is regular monitoring. The borderline between cellular anomaly and irreversible cancerous state is tenuous. It is so easy for the one or the other to swing over. One can anticipate what would mean a treatment able to overturn these lesions development. The "Priore field" has been perfectly good at this (several biopsies bear testimony) and it takes very little at this point to have either the right or the wrong option in dealing with these lesions.

- Mode of application: internal, endocavitary for mouth and vagina external for the face

Third example: Mastoses and other chronic breast anomalies

At times, it is difficult to draw the line between an early **cancer** and a benign lesion to check. Besides, beyond diagnostical uncertainties, a benign lesion may very well grow into a **cancer**. Just imagine the feelings of a woman expecting a verdict from the radiologist every six months. If administered before the disaster, the treatment which helps to stabilize the condition, or even to overrun the tendency, would avoid thousands of mutilations performed on preventive grounds. And indeed how much anxiety would be spared!

- Mode of application : external field.

B - Cancers treated at an early stage or those not easily accessible to classical therapeutics.

Examples consist of certain facial cancers hardly accessible, early prostate or breast cancers.

1. Let us consider a face cancer of inaccurate bounds localized near the eye (see Lakhovsky's healings above). It is a kind of **cancer** that can very well be sensitive to conventional treating methods. In fact, it is impossible to envisage a radiotherapy given the proximity of this fragile organ. In addition, a surgical procedure will leave part of the tumor in place so as not to attack the eye. A recurrence is to be expected.

Here again, the electric treatment permits to get rid of the tumor with no complication and with as much facility as it is superficial.

2. Early Prostate Cancer

It has been observed that, among elderly people who died of a disease other than prostate **cancer**, there were sources of prostatic **cancer** which had remained unnoticed until then, and did not develop despite the lack of treatment. Consequently, a prostate **cancer** in an elderly person may be left untreated if it does not manifest itself, hence, an alternate measure to antihormonal medication to slow down its progress.

However, it is totally different in a young subject where the **cancer** is very often pretty much aggressive. At an early point of the **cancer**, the only thing one may be sure of: aggravation is inescapable. Thus the obvious questions are:

A) Should this early prostate cancer be treated?

B) What are the means available?

One must take into account the growing speed of the tumor, frequent metastases, age of the patient etc. The treatment protocol to try and halt the tumor evolution is complex and very much on discussion. It often combines radiotherapy, chemotherapy and surgery without any guarantee as to their effectiveness as far as survival is concerned. What is beyond doubt is the fact that such a **cancer** will inexorably develop and its progress will be very hard to stop by conventional treatments.

Here, the treatment by electric fields would find a suitable place, as it concerns an early **cancer** not very sensitive to usual therapeutics. Moreover by its localization it is very accessible to electric treatments either external or internal (permanent urethral or rectal catheter/probe, the prostate being a few centimetres from the anus). And we should not forget that nothing prevents that the greater part of this tumor be surgically removed. Let us recall once again the effectiveness of these electric fields on early tumors, before their volume and extension become an obstacle to their action.

3 - Early breast cancer

Still and again for reasons of efficiency and total innocuousness at this level, we dream of the perspectives which are offered by such treatment applied with minimum doubt on a discreet anomaly of the breast, the xray or biopsy of which is not formally reassuring (currently and with justification, certain hormones are being used to stop cancerous degenerescence of some suspicious nodules). So many interventions legitimated through doubt have thus been prevented! To what extent has it been possible to stop **cancer** growth ?

C - Wide tumoral masses and general cancers

We did mention, at the beginning of this chapter, our conviction about the potential appearance of the type of equipment which will be so powerful that our current mutilating techniques will look so antiquated. For the near future, we are equally convinced of the rediscovery of the Priore effect and of its applications by means of devices which, not being powerful enough, will need to be combined with conventional treatments.

If we take the example of a deep **cancer**, less accessible to electric fields, it is possible to combine these fields with conventional surgery, in view of facilitating the treatment and downsizing the tumor considerably. Even targeted radiotherapy can abide by its indications as long as it does not hamper action of the electric treatment. Only the anticancerous chemotherapy is to be feared. All observations indicate the absolute need for a good quality immune system, inescapable for the success of the treatment. Besides, what should be retained from these remarks is that far from antagonizing the two methods, their combination converge to a mutual strengthening of both. It has hence been demonstrated that cancers usually resisting radiotherapy and moderately responsive to electric fields, become sensitive when both methods are associated.

Conclusions

There is every reason to be optimistic for the years to come. The only serious competitiveness to electric fields are certain revolutionary genetic techniques using root cells. We are tempted to say "May the best win!" But yet, is it not more important to win this wonderful battle over death? The works conducted by Priore and other pioneers are sure indication that victory is at hand.

http://www.priore-**cancer**.com/

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Use of Electrotherapy in Germany (pgs 29-31)

Cancer with river fight -
The Electro Cancer Therapy

The number of those, which live at present in Germany with a cancer illness, becomes estimated on two to three million. While a group of patients trusts alone in the conventional tumor therapies (operation, radiotherapy, chemotherapy), the other group aims at a total treatment concept. Here tumor-destructive procedures with complementary therapys measure complement each other. The priority goal of the complementary therapy strategies was so far above all the improvement of the quality of life of the patient. Also a Rezidiv and a Metastasenprophylaxe are awarded to these working methods for some time, since numerous test results grant the crucial meaning to the control and defense mechanisms of the immune system with the tumor genesis.

The direct current treatment finds already for many years a broad application in the medicine, in the Orthopaedie/Sportmedizin and neurology it for pain treatment and for regeneration, for example for faster bone healing was particularly used.

In the Onkologie against it application is relatively new. The Electro Cancer Therapy (ECT) is however particularly suitable for superficial or also deep-convenient kinds of tumor, which are not operable for aesthetic and functional reasons. It is not to confound with hyperthermia or other forms of the electrical therapy! For treatment suitably among other things Mamma mamma-Karzinome, in particular Rezidive after radiating and chemotherapy, are malignant Melanome, Hautkarzinome, like Basaliome, Spinaliome, Melanome, Hautmetastasen, Weichteiltumore, Tumore in the gynaekologischen range, Tumore in the urologischen range etc..

The goal of the use of direct current is the induced necrosis (sterile dying of tumor fabric) of a tumor by a d.c. supply by means of electrode probes in and at the tumor fabric. The direct current, which flows between two or several electrodes, leads to a fabric destruction by means of electrolysis. By the ion migration it comes to a substantial pH value shift in the fabric. The reached pH values lie far outside of the physiological range and are tissue-damaging. The direct current leads also to a change of the Membranpotenziale approximately around and in the cell. The interior of a cell is more negatively charged in contrast to the environment, therefore the cell a Membranpotenzial possesses. The direct current changes the concentration of the charged particles within the range around the cell, so that it comes to a change of the Membranpotenzials. The Potenzialaenderung affects certain diaphragm components, which open with a strong provoking for positively charged ions and deliver to the interior. By the penetration of very many positively charged ions the negative charge in the cell inside changes in positives. The specific equilibrium is disturbed. Now negatively charged immune cells can penetrate into the weakened tumor cell and kill them. Further it comes in the fabric at the cathode to a container extension, at the anode to a drainage, a Schmerzlinderung and an inflammation inhibition. Thus the tumor fabric is devitalisiert. The electrical Devitalisierung is not a usual electrical injury. It is nearly always pain-free and does not disturb not the general condition. A repulsion of the electrically induced fabric fall takes place only after some weeks. The material losses correspond in order of size to the original propagation of the tumor fabric. For a careful cancer therapy it is decisive that the celldestructive effects work exclusively in the tumor fabric and leaves healthy fabric uninfluenced.
With the ECT also a specific immune phenomenon is released, because by the river tumor antigens are presented freely and to the immune cells attracted by the river. Zytokine are set free by the Gewebszerstoerung. In the consequence it comes to a higher erkennungsrate of tumor antigens, which promotes again the immune achievements of the tumor carrier.
The ECT can be accomplished ambulatory. The duration of treatment varies between one until three hours. The range concerned is sterile covered and betaeubt with a pain means. Depending upon tumor size two are necessary or more electrodes, which than thin needles are brought by the skin into the tumor.

During the treatment a lighter pressure pain or an easy Kribbeln in the treated area arises. Since the direct current in the closed fabric causes a long-lasting pain absorption, pain does not arise only rarely or also after the therapy. Developing killing of the cancer fabric leads to an inflammatory reaction, which regresses however after few days. The cancer fabric is diminished on natural way, from which body replaces eliminated and by scar fabrics. After the treatment the patient is to be quite gone in a the position independently home. The ECT is combinable with conventional methods such as chemotherapy, irradiation, hyperthermia, immune and other biological therapies.

Note: The cancer therapies described in this series are not only limited recognized by the school medicine or. The publication exclusively takes place for information and does not mean not that a described method has a positive effect on a cancer illness or a treatment.

Resuming literature:
Pekar, Rudolf:
The percutaneous bio electrical therapy with tumors.
A documentation to basis and practice of the percutaneous Galvanotherapie 2002, 2. Edition, publishing house William Maudrich, 148 sides, 167 color illustrations.
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Review of types of cancer electrotherapy pgs 32-39

ECT • BET • PBE • Galvanotherapy: Healing Cancer With Electricity

Introduction by Healing Cancer Naturally

contd. from previous page

ECT - Healing Cancer With Electricity

Healing cancer with electricity, technically referred to as Electrochemical (Tumor) Therapy, Electro Chemo Therapy, Electro Cancer Therapy (ECT), Bio-Electric Therapy (BET), Percutaneous Bio-Electrotherapy (PBE) or Galvanotherapy is a highly promising and often successful gentle treatment modality which seems to be widely applied in China and in some European venues such as Germany, Austria, Holland, France and Italy. It involves the targeted application of a few milliamps biological electrical DC current to cancerous growths which often results in the complete destruction of malignant tumors. Applied as outpatient treatment, it is superior to surgical excision both because no residual cancer cells are able to survive the process and in respect to expenses incurred.

Over several decades, a German and an Austrian physician, Dr. Pekar and Dr. Rilling, have separately developed methods of healing cancer based on the use of electricity. One of Dr. Pekar's (who is now 93) basic premises: "Health and sickness are related to the bio-electric currents in our body".

I learned about these doctors on TV, where I remember them specifically citing melanoma, prostate and breast cancer as having been healed by their approaches (see below for greater specifics). Dr. Pekar's method in a nutshell: wires are applied directly to the tumor, a few milliamperes are applied for up to 90 minutes; taking melanoma as an example, the cancerous growth will turn into a crust in the space of several weeks (with the crust then being shed by the body). The electric current seals the blood vessels so no metastases are formed (while during operations, the veins are cut which allows cancer cells to swarm). Dr. Pekar posits that cancer is primarily a blood disease and can be detected early via the blood.

When asked why his method wasn't more commonly applied, Dr. Pekar replied (his exact words), "Medizin ist ein Geschäft [Medicine is about making money/Medicine is where a lot of money is and can be made]. And with the method I have developed, there isn't much money to be made." He added, "doctors studied so many things at school that my method appears too simple to them."

Dr. Siegfried Rilling, MD, has developed a method he calls Biotonometrie based on the electric quality of the human body.

The following articles while furnishing scientific details will also give an excellent general introduction to the subject:

Types of Tumors Responding to Galvanotherapy
(excerpted from article "Galvanotherapy Percutaneous Bio-Electrotherapy for the Elimination of Malignant Tumors" by Morton Walker)

Electrochemical Tumor Therapy (ECT) for Malignancies
by Stephan Seeßle, MD

Bio-Electric Therapy (BET) For the Elimination of Malignant Tumors
(excerpted from article by Dr. Jorge Llamas, MD)

Prof. Dr. Yu-Ling Xin's treatment statistics concerning ECT (Electro Chemo Therapy)

Types of Tumors Responding to Galvanotherapy
(excerpted from Galvanotherapy Percutaneous Bio-Electrotherapy for the Elimination of Malignant Tumors. Townsend Letter for Doctors and Patients, Nov, 2001, by Morton Walker)

Particular tumor types respond well to galvanotherapy. Under the ministrations of Dr. med. Rudolf Pekar and his oncolgical colleagues, this form of electrotherapy is successful for eliminating the following malignant conditions:
* Breast cancers
* Mouth and throat cancers
* Esophageal and stomach cancers
* Lung cancers
* Vaginal cancers
* Melanomas and basal-cell carcinomas
* Skin metastases
* Lymph node metastases
* Liver metastases
* Mycosis fungoides
* Rectal cancer & anal cancer

The use of GT for malignant tumor removal has many advantages. Such benefits consist of the following:
a. The organ involved is preserved with no problematic scarring.
b. The electrical needles are applied under local anesthesia without risks.
c. None of the side effects which may be connected with general anesthesia are present.
d. No damage occurs to healthy tissue.
e. As a result of lysed tumor components being presented to the immune system for removal, an additional immune stimulation takes

place.
From receiving galvanotherapy, certain types of cancer patients benefit greatly. Such malignancy types include:
* those with small primary tumors of less than 5 cm in diameter;
* those with solitary metastases, especially in the skin and lymph nodes;
* those with recurrences in the region of an operation such as a mastectomy scar;
* those who have inoperable external tumors.

Read Morton Walker's excellent detailed article in full. Covers "Galvanotherapy for the Elimination of Cancerous Lesions", " How Galvanotherapy is Administered to a Patient", "History of Pekar's Percutaneous Bio-Electrotherapy Invention", "The Physiological Mechanism of Anti-Cancer Galvanotherapy". While "[d]escribing the treatment with as little medical/electrical! technical language as possible, this article will provide medical consumers and health professionals with information on galvanotherapy as a means of eliminating cancerous lesions."

Electrochemical Tumor Therapy (ECT) for Malignancies
by Stephan Seeßle, MD www.ect-seessle.de

Healing with electric currents

In view of the fact that there are still many open questions after decades of cancer research and considering the moderate success rate of treatment, we see new hope in a therapy which has not been used in Germany up to now. It is named percutaneous Bio-Electrotherapy (BET) or also electrochemical tumor therapy (ECT).

After introduction of this treatment to China by Dr. Bjorn Nordenstroem, this effective and surprisingly low-cost therapy has been used in 108 Chinese hospitals. Countries such as Japan, USA, Italy, Slovenia and Denmark have shown a research interest in this new treatment modality. In Germany there is a private clinic in Bad Aibling and the University Hospital in Witten-Herdecke which use ECT treatment.

Too low-cost?

Maybe that is the reason which prevented mainstream medicine and oncology to develop an interest in this therapy.

Oncology is one of the most expensive and most profitable fields of medicine.

Next to Dr. Nordenstroem and Prof. Yu Ling Xin from Peking we must mention Dr. Rudolf Pekar from Bad Ischl in Austria who developed percutaneous electrotherapy after many years of research and practical application. He documented his findings in a book

published by Verlag Wilhelm Maudrich* which will serve as the basic source of this article. His theory is based upon the fact that each cell carries a specific electromagnetic field giving rise to bioelectric currents and frequencies in all biological materials. Pekar found that **every tumor has an altered electric field which extends beyond the tumor's borders and which is polarised toward the surrounding tissue. (This field does not automatically disappear after surgical removal of the tumor, a fact which can be measured and proved and which explains the high rate of recurrencies after surgery)**. We may conclude that an influence exerted upon this field should also affect and modify the tumor.

Healing with electric currents

Romans had already used animal electricity (electric ray) for medical treatment. Electrotherapy was a standard treatment modality at the beginning of the last century, but interest was lost in the years to come. First attempts of selective electrocoagulation of tumors were made in 1924. Biological effects of electric currents have been researched extensively by Prof. Dr. Stefan Jellinek of Vienna (1871-1968). Rudolf Pekar started his research into galvanic microcurrents and his practical work in 1969 and has been able to help many cancer patients since that time.

In order to understand the mechanism of cancer cells and the fact that they are "masked" from the immune system, one has to look deeper into the functioning of bioelectric currents. An electric voltage is part of all functions in living tissue. It arises primarily at the cellular walls and gives rise to electric currents. That much has been known for a long time in medicine. Movement of electrons along a DC field is being used in e.g. iontophoresis and electrophoresis. Cell membranes contain ion channels. They carry a negative charge at the outside of the cell membrane and show selectivity for kations, particularly for sodium and potassium ions. Part of these ion channels open only after adequate change of the membrane potential.

Cell life depends on the nutritional input and adequate excretion of metabolic end products. Both pathways use the ion channels.

This metabolism constitutes the flow of electric current. If a cell does not function normally, it emits an electromagnetic field which differs from the healthy field condition. Cancer cells carry a negative membrane potential which is proportional to the degree of their malignancy. This change in potential enables the cell to separate from other cells and to maintain its masking capabilities towards the reconnaissance function of the immune system. The cell's altered protein metabolism produces a membrane attacking enzyme which enables it to penetrate and to infiltrate normal surrounding tissue (Pekar). Cell resonance changes and the dynamic condition of tissue is being destroyed through polarity change.

As a result we see a decrease in the electric blockage of cancer-inducing information. It is exactly at this point where the new therapy becomes active.

An adjustable DC current is introduced directly into the tumor with the help of electrodes. This triggers the following reactions:

Depolarisation and penetration of tumor cell membranes leading to a disturbance of metabolic function and intercellular structure. The energetic ionic flow of current is re-established at the same time in accordance with the naturally intended structure of the organism.

This represents an iatrogenic stimulation of self-healing and an activation of the immune system.

Pekar also maintains that 'every tumor is registered in the central nervous system and that this CNS representation can be treated with electric currents.' [Compare Dr. Hamer’s New Medicine]

Sending electric currents through tumour tissue leads to electrolytic changes at the electrodes which in turn causes significant alterations of the pH value. As that pH value differs from the normal physiological range it will be destructive for tumor tissue. The results show an aseptic necrosis of tissue and an accompanying "unmasking" of the cancer cells now made recognizable to the immune system.

The phagocytic cells (stimulated where required via additional immunotherapy) will break down and destroy the dead remnants of the tumor within one to three weeks.

So far, there have been no side effects associated with this treatment and there is no reason to expect them. (The degree of malignancy plays no part).

A great deal of expertise is required for proper placement of electrodes and optimal adjustment of current intensity which must be set in accordance with the size, density and type of tumor being treated. Rudolf Pekar and others have published suggestions for appropriate treatment modalities based on their experience. A therapeutic device for this purpose is available. A single treatment session lasts 10 to 90 minutes, can be performed as an outpatient procedure, and does usually not produce any pain or inflammation. The patient can leave the doctor's office right after treatment. This therapy is suitable both for superficial and deeper tumors, such as breast cancer, ENT tumors, all types of skin cancer, isolated metastasis of internal organs, soft tissue tumors, lymph node. Tumours pretreated radiologically or with chemotherapy as well as metastases within lymphatic areas spreading throughout the body and bone metastases (osteometastasis) can be treated to a limited extent.

A case history:

Laboratory results for a 61 years old patient undergoing a routine check-up examination show a significantly low unbound testosterone level of 0.52 mcg/ml. The ratio between total and unbound testosterone is a good marker for malignant changes of the prostate if the result shows a low value. The patient was subsequently referred to an urologist who discovered a suspicious area by rectal sonography and performed multiple biopsies. The histologic examination of the specimens revealed a poorly differentiated glandular carcinoma of the prostate (grading G 1). The treatment plan suggested included radical prostatectomy in combination with percutaneous radiation treatment. ECT treatment was discussed as an alternative to this standard treatment modality. The patient was

then treated by ECT for 15 minutes under local anaesthesia followed by an adjuvant androgen deprivation therapy for 12 months until November 1999. Ultrasound examination after this period showed some densities within a distinctly smaller prostate gland without any suspicious lesions. A repeat biopsy which was already performed in May 1999 did not reveal any malignant cells after histologic examination. Therefore one must assume, that the course of malignancy has been reversed.

**Pekar, Rudolf: "Die perkutane Bio-Elektrotherapie bei Tumoren. Eine Dokumentation zu Grundlage und Praxis der perkutanen Galvanotherapie".*
[Percutaneous Bio-Electrotherapy of Cancerous Tumours. A Documentation of Basic Principles and Experiences with Bio-Electrotherapy]
Foreword by Ferdinand Ruzicka. 1996. 148 p. w. 167 colour plates, 2 sketches, 1 table, ISBN: 3-85175-657-6 and 3-85175-678-9, Euro 50,00. Currently only available in German. Here is the publisher's introduction to the book:
Cancer tumours represent an ever growing problem in our modern society. The author of this book introduces an innovative method involving electricity, as a possible solution in the fight against malignant tumours.
After a historical introduction of this method's development and a description of the human bio-electric system, the author gives a clear view of its practical uses. He explains the advantages and methods in therapy with extensive picture documentation. His methods and descriptions are based on experience and test results of easily reached tumours with direct bio-electric influence. He also suggests the possibility of using his methods sui generis or combining their use with conventional methods of tumour treatment. The instruments needed for treatment are displayed with photos and their use well described.
This book is a pioneering work in bio-electric therapy, an effective and non-aggressive form of tumour treatment. Patients get an idea of the possibilities that lie for them from it and doctors should be encouraged to learn about and to treat certain tumours themselves with these methods.
The 200-year old model of biological matter, introduced by Dalton in 1808, is still widely in use. This model is based on a highly simplified assumption that matter consists ultimately of indivisible discrete particles called atoms. The attraction of atoms to each other leads to a chemical reaction.
The binding forces between the atoms are visualised with abstract lines.
Besides the chemical reactions between matter, an additional, more profound counter effect has been observed since Dalton introduced his theory. Matter, particularly biological matter, radiates electromagnetic fields at all times. Already as a young doctor, Pekar realised this fact.
In his book, you find unequalled expressed basic knowledge: "Every biological process is also an electric process" and "health and sickness are related to the bio-electric currents in our body"
The knowledge about the automatic control with bio-electric currents and magnetic fields of our body to hold homeostasis, is put into praxis by Pekar in his pioneering work. With electric circuits he destroyed tumour cells; he got tumours to disappear entirely.
This book is a conclusive documentation about careful healing of malignomas. The author's hypothesis: "Health and sickness are related to the bio-electric currents in our body is a new paradigm of understanding biological substance.
The application of that knowledge in therapy and the application of electric current into the tumour with needle electrodes are epoch-

making ventures.
Swen Alfas, Chairman of the Academy for Applied Knowledge International, Kopenhagen, Denmark

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Bio-Electric Therapy (BET) For the Elimination of Malignant Tumors
by Dr. Jorge Llamas, MD (excerpted from the full article)

Bio-Electric therapy has been used clinically for many years. It has been applied in orthopedics, where it has been used for regeneration and healing of broken bones as well as in the treatment of pain. In oncology ... the use of BioElectric Therapy (BET) is ... the result of research investigations by Dr. Rudolf Pekar and Björn Nordenström. Electrodes are attached to acupuncture needles that are inserted directly into the tumor or into the skin surrounding the tumor. Applying the correct level of voltage (usually only 9.5 to 10 volts) and low micro-amperage results in the destruction of cancerous cells.

...As soon as direct current is connected to the electrodes, different electrochemical reactions influence the pH value and can cause electrolysis of tumor tissue. Depolarization of the cell membrane changes the cellular environment, forcing the tumor cells to be gently destroyed. The consequence of this process is the interruption of certain functions within the cancerous cells, which, in turn, can lead to the destruction of these cells. The application of direct current causes tumor cells to lose their immune disguise and be transformed, within minutes, into an allergen. The tumor then becomes recognizable by the immune system, which then activates the proper defense cascade, including cytokines and interferon and most importantly, the cytotoxic T-cells.

What Types of Tumors are Suitable for BET?

BET is suitable for all types of superficial or deep-seated tumors that can be reached by needle electrodes. Specifically:

* Small mamma carcinomas or isolated axillary supraclavicular and thorax nodes.
* All tumors of the ear, nose and throat area, especially after radiation or chemotherapy.
* Skin carcinomas, e.g., Basaliome, Spino-cellular carcinoma, Melanoma, etc.
* Gynaecological carcinomas.
* Soft tissue tumors.

Special Form of BET using Cytostatic Substances (Iontophoresis)

The destructive effect of the direct current on tumorous tissue can be enhanced by the simultaneous administration of cytostatic substances, such as Mitomycin, Adrimycin, Epirubicin and Cis-Platinum. Most cytostatic substances are positively charged, causing them to be attracted to the negatively charged cathodes within the electrical field created around the tumorous tissue (iontophoresis movement).

In this way, cytostatics can be introduced into the tumorous tissue in a very targeted and concentrated manner. This method can be more effective on the tumor site than standard systemic chemotherapy or local cytostatic perfusion. Cytostatic substances are best applied to hollow organs - for example, esophagus, bladder, stomach and rectum. The membrane potentials are changed so much by the current that the cells open and absorb cytostatic substance more rapidly.

...During the treatment, the patient will experience a slight pressure pain or a slight tingling in the treated area. Direct current brings about long lasting pain relief because it inhibits the activity of sensory nerve fibers. Therefore, there is no pain after treatment.

At the Second International Conference of Bio-Electrotherapy for Cancer held in Stockholm, Sweden, in 1993, the Chinese oncological participants reported that their administration of BET to 4,000 cancer patients resulted in an accumulation of Complete Remissions and Partial Remissions (CR+PR) exceeding 80%.

BioElectric Therapy is safe and effective, does not require any hospitalization, complements other therapies, and has a low price tag when compared to surgical intervention.

Prof. Dr. Yu-Ling Xin’s treatment statistics concerning ECT (Electro Chemo Therapy)

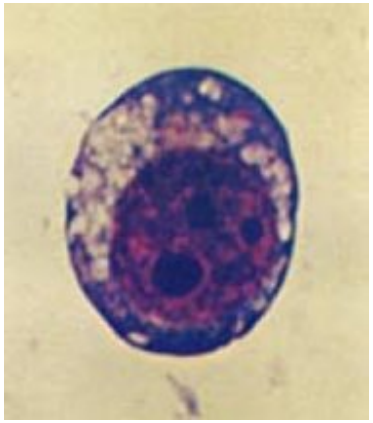
Prof. Xin, Peking, has written a "treatment statistics concerning ECT (Electro Chemo Therapy) in 9011 cases of different types of tumor" compiled from 168 clinics. More articles by him et al. can be found on the Internet.

According to one German source (a naturopathic institute applying Electro Cancer Therapy), this treatment modality is recommended and endorsed by the National Cancer Control Society L.A. and the American Academy of Preventive Medicine Cap. Can. Fl. (among other associations).

Center for Bioelectrics (pgs 40-51)

Bioelectrics refers to the use of pulsed power, or the application of powerful electrical pulses, for extremely short periods of time, to manipulate biological cells, tissues and/or organisms.Researchers at the Center for Bioelectrics are testing the use of these high-intensity electrical surges to remove diseased or unwanted cells or groups of cells, such as tumors. Use of this technology in medicine and biology is the first of its kind in the world. **The biomedical applications, based on ultrafast pulse-cell interactions, have extraordinary potential to treat persons with cancer, cardiovascular disease and other conditions.** A promising branch of bioelectrics within environmental sciences involves the use of electric pulses that may be used to generate nonthermal ionized gases (cold plasmas) as a means for bacterial, viral and chemical decontamination. This technology provides a new, environmentally benign, non-chemical means of decontamination of gases, liquids and solids, such as food.

Research Overview



High-intensity pulsed electric fields with ultrashort duration have been proven to target intracellular structures and functions without permanent damage to the cell membrane. **Applications include the possibility to kill cancer cells and tissues,** as well as other unwanted or aberrant cells, such as warts, moles or fat cells, and also to sculpt tissues during plastic or reconstructive surgery. Using different parameters, cell functions appear to be enhanced. This could allow for applications for wound healing and regeneration of damaged cells and tissues.

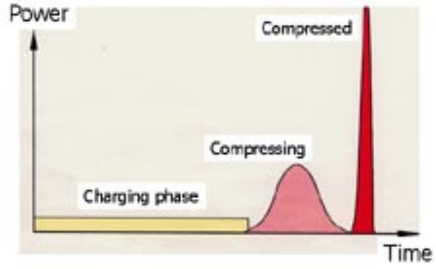
Also under development is a dual pulsing system combining long pulses, which open pores in the outer cell membrane, and short pulses, that affect intracellular structures and molecular transport, to enhance gene delivery to the nucleus. The application of this new

technology will be of great value in basic molecular biology, by promoting an understanding of mechanisms that regulate gene expression, and in clinical medicine.

Bioelectrics (Engineering) Research and Development

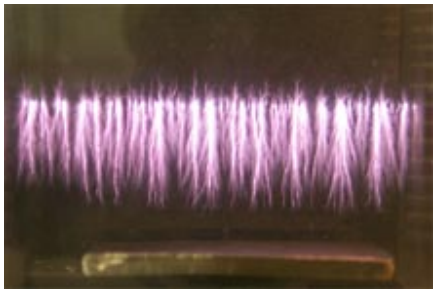
The Center will provide laboratory facilities, equipment, meeting space and administrative and technical support to allow the participating scientists and engineers to perform high quality research on bioelectric devices and diagnostic techniques. These devices and techniques will serve the resident research teams in their efforts and may be made available to outside users, such as biotech companies, to allow them to carry out research in the collaborative laboratories available on site.

Pulsed Power



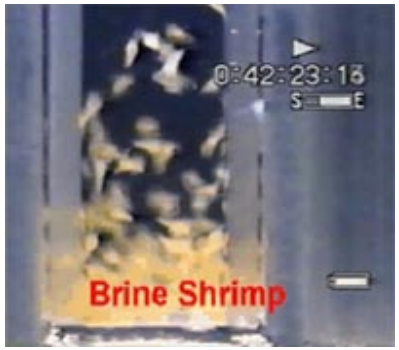
Pulsed power physics and technology is the enabling technology for bioelectrics. It refers to the compression of electrical energy to times of less than one nanosecond. This energy compression corresponds to an amplification of power, reaching short-term power levels of terawatts. However, because of the ultrashort energy transfer times, heating of the biological material is avoided.

Cold Plasmas



The technology of cold ionized gases has recently reached a level of maturity at which applications can be considered. Cold plasmas consist of electrons and ions in gases at high pressure, up to and even exceeding atmospheric pressure. The charged particles in these cold plasmas are successfully used to decontaminate surfaces.

Enviromental Applications



Pulsed electric fields are used to decontaminate liquids, particularly liquid food. Other applications include bacterial decontamination of water using combinations of pulsed power and cold plasma technology, and using pulsed electric fields for biofouling prevention.Cold plasmas have also proven to be efficient in bacterial decontamination, in this case, of gases. High-pressure plasmas, which can be generated in atmospheric pressure air, are effective in bacterial decontamination, and also in chemical decontamination.

Various carcinogens, used in industrial processes, have been eliminated when contaminated gases were exhausted through such cold plasmas.

Commercial Applications

These new technologies offer a wide range of applications, including cancer treatment, wound healing, tissue regeneration, gene delivery into cell nuclei, bacterial decontamination of liquid food, along with other areas of relevance that have a high likelihood of emerging as additional research proceeds.

- **The effect of ultrashort electrical pulses on malignant tumors in vivo**
- Drug delivery directly into cells
- Biological decontamination of water and biofouling protection using electrical fields
- Biological decontamination of air using atmospheric pressure glow discharge
- Intracellular electromanipulation for tissue sculpting and tissue regeneration
- Chemical decontamination of gases, liquids, and solids using cold plasmas

Current Publications on Bioelectrics

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The Electrical Properties of Cancer Cells (pgs 51-113)

By: Steve Haltiwanger M.D., C.C.N.

Sections:

1. Introduction
2. Electricity, charge carriers and electrical properties of cells.
3. Cellular electrical properties and electromagnetic fields (EMF).
4. Attunement.
5. More details about the electrical roles of membranes and mitochondria.
6. What structures are involved in cancerous transformation?
7. Electronic roles of the cell membrane and the electrical charge of cell surface coats.
8. Cells actually have a number of discrete electrical zones.

9. The electrical properties of cancer cells part 1.
10. The electrical properties of cancer cells part 2.
11. Anatomical concepts
    - The intravascular space and its components
    - The cell membrane covering of cells and the attached glycocalyx: Chemical and anatomical roles of the cell membrane.
    - The extracellular space and the components of the extracellular matrix (ECM) connect to the cytoskeleton of the cells: The electronic functions of the cells and the ECM are involved in healing and tissue regeneration.
    - The ECM-glycocalyx-membrane interface
    - The intracellular space
12. Signaling mechanisms may be either chemically or resonantly mediated.
13. Resonance communication mechanisms.
14. The Bioelectrical control system.
15. Electrical properties of the ECM
16. Pathology of the ECM.
17. Mineral and water abnormalities in cancerous and injured tissues: sodium, potassium, magnesium and calcium: their effect on cell membrane potential.
18. Tumor cell differentiation, tumor hypoxia and low cellular pH can affect: gene expression, genetic stability, genetic repair, protein structures, protein activity, intracellular mineral concentrations, and types of metabolic pathways used for energy production.
19. Tumor cells express several adaptations in order to sustain their sugar addiction and metabolic strategies to address this issue.
20. Tumor acidification versus tumor alkalization.
21. The pH of the intracellular and extracellular compartments will also affect the intracellular potassium concentration.
22. Tumor cell coats contain human chorionic gonadotropin and sialic acid as well as negatively charged residues of RNA, which give tumor cells a strong negative charge on their cell surface.
23. Biologically Closed Electric Circuits.
24. Bacteria and viruses in cancer.
25. Treatment devices.
26. Polychromatic states and health: a unifying theory?
27. **Treatment Section:**

Topics to be covered on the electrical properties of cancer cells

pH changes
Mineral changes
Structural membrane changes
Membrane potential changes
Extracellular matrix changes

Protein changes
Gene changes
Sialic acid-tumor coats- negative charge
Sialic acid in viral coats and role of drugs, blood electricfication, nutrients to change infectivity

Introduction

About 100 years ago in the Western world **the study of biochemical interactions** became the prevailing paradigm used to explain cellular functions and disease progression. The pharmaceutical industry subsequently became very successful in using this model in developing a series of effective drugs. As medicine became transformed into a huge business, during the 20th century, medical treatments became largely based on drug therapies. These pharmaceutical successes have enabled pharmaceutical manufacturers to become wealthy and the dominant influence in medicine. At this point in time, the supremacy of the biochemical paradigm and pharmaceutical influences have caused almost all research in medicine to be directed toward understanding the chemistry of the body and the effects that patentable drugs have on altering that chemistry. Yet many biological questions cannot be answered with biochemical explanations alone, such as the role of endogenously created electromagnetic fields and electrical currents in the body.

Albert Szent-Gyorgyi in his book Bioelectronics voiced his concern about some of the unanswered questions in biology: "No doubt, molecular biochemistry has harvested the greatest success and has given a solid foundation to biology. However, there are indications that it has overlooked major problems, if not a whole dimension, for some of the existing questions remain unanswered, if not unasked (Szent-Gyorgyi, 1968).” Szent-Gyorgyi believed that biochemical explanations alone fail to explain the role of electricity in cellular regulation. He believed that the cells of the body possess *electrical mechanisms* and use electricity to regulate and control the transduction of chemical energy and other life processes.

Dr. Aleksandr Samuilovich Presman in his 1970 book *Electromagnetic Fields and Life* identified several significant effects of the interaction of electromagnetic fields with living organisms. Electromagnetic fields: 1) have **information and communication roles** in that they are employed by living organisms as information conveyors from the environment to the organism, within the organism and among organisms and 2) are involved in life’s vital processes in that they **facilitate pattern formation, organization and growth control** within the organism (Presman, 1970). If living organisms possess the ability to utilize electromagnetic fields and electricity there must exist physical structures within the cells that facilitate the sensing, transducing, storing and transmitting of this form of energy.

Normal cells possess the ability to communicate information inside themselves and between other cells. The coordination of information by the cells of the body is involved in the regulation and integration of cellular functions and cell growth. When cancer arises cancer cells are no longer regulated by the normal control mechanisms.

When an injury occurs in the body normal cells proliferate and either replace the destroyed and damaged cells with new cells or scar tissue. One characteristic feature of both proliferating cells and cancer cells is that these cells have cell membrane potentials that are

lower than the cell membrane potential of healthy adult cells (Cone, 1975). After the repair is completed the normal cells in the area of injury stop growing and their membrane potential returns to normal. In cancerous tissue the electrical potential of cell membranes is **maintained at a lower level** than that of healthy cells and electrical connections are disrupted.

Cancerous cells also possess other features that are different from normal proliferating cells. Normal cells are well organized in their growth, form strong contacts with their neighbors and stop growing when they repair the area of injury, due to contact inhibition with other cells. Cancer cells are more easily detached and do not exhibit contact inhibition of their growth. Cancer cells become independent of normal tissue signaling and growth control mechanisms. In a sense cancer cells have become desynchronized from the rest of the body.

I will present information in this monograph on some of the abnormalities that have been identified in cancer cells that contribute to loss of growth control from the perspective that cancer cells possess different electrical and chemical properties than normal cells. It is my opinion that the reestablishment of healthy cell membrane potentials and electrical connections by nutritional and other types of therapeutic strategies can assist in the restoration of healthy metabolism.

In writing this monograph I have come to the opinion that **liquid crystal components of cells** and the extracellular matrix of the body possess many of the features of electronic circuits. I believe that components analogous to conductors, semiconductors, resistors, transistors, capacitors, inductor coils, transducers, switches, generators and batteries exist in biological tissue.

Examples of components that allow cells to function as solid-state electronic devices include: transducers (membrane receptors), inductors (membrane receptors and DNA), capacitors (cell and organelle membranes), resonators (membranes and DNA), tuning circuits (membrane-protein complexes), and semiconductors (liquid crystal protein polymers).

The information I will present in this monograph is complex with many processes happening simultaneously. So I have attempted to group information into areas of discussion. This approach does cause some overlap so some information will be repeated. The major hypothesis of this monograph is that cancer cells have different electrical and metabolic properties due to abnormalities in structures outside of the nucleus. The recognition that cancer cells have different electrical properties leads to my hypothesis that therapies that address these electrical abnormalities may have some benefit in cancer treatment.

Electricity, charge carriers and electrical properties of cells

- The cells of the body are composed of matter. Matter itself is composed of atoms, which are mixtures of negatively charged electrons, positively charged protons and electrically neutral neutrons.
- **Electric charges** – When an electron is forced out of its orbit around the nucleus of an atom the electron’s action is known as electricity. An electron, an atom, or a material with an excess of electrons has a negative charge. An atom or a substance with a deficiency of electrons has a positive charge. Like charges repel unlike charges attract.

- **Electrical potentials** – are created in biological structures when charges are separated. A material with an electrical potential possess the capacity to do work.
- **Electric field** – " An electric field forms around any electric charge (Becker, 1985)." The potential difference between two points produces an electric field represented by electric lines of flux. The negative pole always has more electrons than the positive pole.
- **Electricity** is the flow of mobile charge carriers in a conductor or a semiconductor from areas of high charge to areas of low charge driven by the electrical force. Any machinery whether it is mechanical or biological that possesses the ability to harness this electrical force has the ability to do work.
- **Voltage also called the potential difference or electromotive force** – A current will not flow unless it gets a push. When two areas of unequal charge are connected a current will flow in an attempt to equalize the charge difference. The difference in potential between two points gives rise to a voltage, which causes charge carriers to move and current to flow when the points are connected. This force cause motion and causes work to be done.
- **Current** – is the rate of flow of charge carriers in a substance past a point. The unit of measure is the ampere. In inorganic materials electrons carry the current. In biological tissues both mobile ions and electrons carry currents. In order to make electrical currents flow a potential difference must exist and the excess electrons on the negatively charged material will be pulled toward the positively charged material. A flowing electric current always produces an expanding magnetic field with lines of force at a 90-degree angle to the direction of current flow. When a current increases or decreases the magnetic field strength increases or decreases the same way.
- **Conductor** - in electrical terms a conductor is a material in which the electrons are mobile.
- **Insulator** – is a material that has very few free electrons.
- **Semiconductor** – is a material that has properties of both insulators and conductors. In general semiconductors conduct electricity in one direction better than they will in the other direction. Semiconductors can functions as conductors or an insulators depending on the direction the current is flowing.
- **Resistance** – No materials whether they are non-biological or biological will perfectly conduct electricity. All materials will resist the flow of an electric charge through it, causing a dissipation of energy as heat. Resistance is measured in ohms, according to Ohm's law. In simple DC circuits resistance equals impedance.
- **Impedance** - denotes the relation between the voltage and the current in a component or system. Impedance is usually described "as the **opposition** to the flow of an alternating electric current through a conductor. However, impedance is a broader concept that includes the **phase shift** between the voltage and the current (Ivorra, 2002)."
- **Inductance** – The expansion or contraction of a magnetic field varies as the current varies and causes an electromotive force of self-induction, which opposes any further change in the current. Coils have greater inductance than straight conductors so in electronic terms coils are called inductors. When a conductor is coiled the magnetic field produced by current flow expands across adjacent coil turns. When the current changes the induced magnetic field that is created also changes and creates a force called the counter emf that opposes changes in the current. This effect does not occur in static conditions in DC circuits when the current is steady. The effect only arises in a DC circuit when the current experiences a change in value. When current flow

in a DC circuit rapidly falls the magnetic field also rapidly collapses and has the capability of generating a high induced emf that at times can be many times the original source voltage. Higher induced voltages may be created in an inductive circuit by increasing the speed of current changes and increasing the number of coils. In alternating current (AC) circuits the current is continuously changing so that the induced emf will affect current flow at all times. *I would like to interject at this point that a number of membrane proteins as well as DNA consist of helical coils, which may allow them to electronically function as inductor coils. Also some research that I have seen also indicates that biological tissues may possess superconducting properties. If certain membrane proteins and the DNA actually function as electrical inductors they may enable the cell to transiently produce very high electrical voltages.* ***(Note: this may provide a clue to explain the high voltage occasionally associated with healers and persons who affect photovoltaic lights, delicate electronic devices, watches, computers, etc….J.Beal.)*** **Capacitance** - is the ability to accumulate and store charge from a circuit and later give it back to a circuit. In DC circuits capacitance opposes any change in circuit voltage. In a simple DC circuit current flow stops when a capacitor becomes charged. Capacitance is defined by the measure of the quantity of charge that has to be moved across the membrane to produce a unit change in membrane potential.

- **Capacitors** – in electrical equipment are composed of two plates of conducting metals that sandwich an insulating material. Energy is taken from a circuit to supply and store charge on the plates. Energy is returned to the circuit when the charge is removed. The area of the plates, the amount of plate separation and the type of dielectric material used all affect the capacitance. The dielectric characteristics of a material include both conductive and capacitive properties (Reilly, 1998). In cells the cell membrane is a leaky dielectric. *This means that any condition, illness or change in dietary intake that affects the composition of the cell membranes and their associated minerals can affect and alter cellular capacitance.*
- Inductors in electronic equipment exist in series and in parallel with other inductors as well as with resistors and capacitors. Resistors slow down the rate of conductance by brute force. Inductors impede the flow of electrical charges by temporarily *storing energy as a magnetic field* that gives back the energy later. Capacitors impede the flow of electric current by *storing the energy as an electric field.* Capacitance becomes an important electrical property in AC circuits and pulsating DC circuits. The tissues of the body contain pulsating DC circuits (Becker and Selden, 1985) and AC electric fields (Liboff, 1997).

Cellular electrical properties and electromagnetic fields (EMF)
EMF effects on cells that I will discuss in later sections of this monograph include:

- Ligand receptor interactions of hormones, growth factors, cytokines and neurotransmitters leading to alteration/initiation of membrane regulation of internal cellular processes.
- Alteration of mineral entry through the cell membrane.
- Activation or inhibition of cytoplasmic enzyme reactions.
- Increasing the electrical potential and capacitance of the cell membrane.
- Changes in dipole orientation.
- Activation of the DNA helix possibly by untwisting of the helix leading to increase reading and transcription of codons and increase in protein synthesis

- Activation of cell membrane receptors that act as **antennas** for certain windows of frequency and amplitude leading to the concepts of electromagnetic reception, transduction and attunement.

Attunement:

- In my opinion there are multiple **structures in cell that act as electronic components**. If biological tissues and components of biological tissues can **receive**, **transduce** and **transmit** electric, acoustic, magnetic, mechanical and thermal vibrations, then this ***(becomes "Holographic Communication", which)*** may help explain such phenomena as:

1. Biological reactions to atmospheric electromagnetic and ionic disturbance (sunspots, thunder storms and earthquakes).
2. Biological reactions to the earth's geomagnetic and Schumann fields.
3. Biological reactions to hands on healing.
4. Biological responses to machines that produce electric, magnetic, photonic and acoustical vibrations (frequency generators).
5. Medical devices that detect, analyze and alter biological electromagnetic fields (the biofield).
6. How techniques such as acupuncture, moxibustion, and laser (photonic) acupuncture can result in healing effects and movement of Chi?
7. How body work such as deep tissue massage, rolfing, physical therapy, chiropractic can promote healing?
8. Holographic communication. ***(this, to me, is the term covering, or related to, <u>all</u> the other 11 explanations you list here! See my comment above….J. Beal)***
9. How neural therapy works?
10. How electrodermal screening works?
11. How some individuals have the capability of feeling, interpreting and correcting alterations in another individual's biofield?
12. How weak EMFs have biological importance?

In order to understand **how weak EMFs have biological effects** it is important to understand certain concepts that:

1. Many scientists still believe that weak EMFs have little to no biological effects.
    a. Like all beliefs this belief is open to question and is built on certain scientific assumptions.
    b. These assumptions are based on the **thermal paradigm** and the **ionizing paradigm**. These paradigms are based on the scientific beliefs that an EMF's effect on biological tissue is primarily thermal or ionizing.
2. Electric fields need to be measured not just as strong or weak, but also as low carriers or high carriers of information. Because electric fields conventionally defined as strong thermally may be low in biological information content and electric fields conventionally considered as thermally weak or non-ionizing may be high in biological information content if the proper receiving equipment exists in biological tissues.
3. **Weak electromagnetic fields** are: bioenergetic, bioinformational, non-ionizing and non- thermal and exert measurable biological effects. Weak electromagnetic fields have effects on biological organisms, tissues and cells that are **highly frequency specific** and the **dose response curve is non linear**. Because the effects of weak electromagnetic fields are non-linear, fields in the proper frequency and amplitude windows may produce large effects, which may be beneficial or harmful.

Homeopathy is an example of the use of aweak field with a beneficial electromagnetic effect. Examples of a thermally weak, but high informational content fields of the right frequency range are **visible light** and **healing touch**.

4. Biological tissues have electronic components that can receive, transduce, transmit weak electronic signals that are actually below thermal noise
5. Biological organisms use weak electromagnetic fields (electric and photonic) to communicate with all parts of themselves
6. An electric field can carry information through frequency and amplitude fluctuations.
7. Biological organisms are holograms***(Concur, but would like some detail here. I believe Pribrim, in the early 70's considered the brain received, stored, and processed info in a holographic way…..J. Beal)***
8. Those healthy biological organisms have coherent biofields and unhealthy organisms have field disruptions and unintegrated signals.
9. Corrective measures to correct field disruptions and improve field integration such as acupuncture; neural therapy and resonant repatterning therapy promote health.

More details about the electrical roles of membranes and mitochondria

- Electricity in the body comes from the food that we eat and the air that we breathe (Brown, 1999). Cells derive their energy from enzyme catalyzed chemical reactions, which involves the oxidation of fats, proteins and carbohydrates. Cells can produce energy by oxygen-dependent aerobic enzyme pathways and by less efficient fermentation pathways.
- The specialized proteins and enzymes involved in oxidative phosphorylation are located on the inner mitochondrial membrane and form a molecular respiratory chain or wire. This molecular wire (electron transport chain) passes electrons donated by several important electron donors through a series of intermediate compounds to molecular oxygen, which becomes reduced to water. In the process ADP is converted into ATP.
- When the electron donors of the respiratory chain NADH and FADH2 release their electrons hydrogen ions are also released. These positively charged hydrogen ions are pumped out of the mitochondrial matrix across the inner mitochondrial membrane creating an electrochemical gradient. At the last stage of the respiratory chain these hydrogen ions are allowed to flow back across the inner mitochondrial membrane and they drive a molecular motor called ATP synthase in the creation of ATP like water drives a water wheel (Stipanuk, 2000). *This normal energy production process utilizing electron transport and hydrogen ion gradients across the mitochondrial membrane is disrupted when cells become cancerous.*

What structures are involved in cancerous transformation?

- Many current cancer researchers believe that cancerous transformation arises due to changes in the genetic code. However more seems to be going on than genetic abnormalities alone. A series of papers written by Ilmensee, Mintz and Hoppe in the 1970-1980's showed that replacing the fertilized nucleus of a mouse ovum by the nucleus of a teratocarcinoma did not create a mouse with cancer. Instead the mice when born were cancer free (Seeger and Wolz, 1990). These studies suggest the theory that abnormalities in other cell structures outside of the nucleus such as the cell membrane and the mitochondria and functional disturbances in cellular energy production and cell membrane potential are also involved in cancerous transformation.
  In examining the data to support this theory I found:

- As far back as 1938 Dr. Paul Gerhardt Seeger originated the idea that destruction or inactivation of enzymes, like cytochrome oxidase, in the respiratory chain of the mitochondria was involved in the development of cancer. Seeger indicated in his publications that the initiation of malignant degeneration was due to alterations not to the nucleus, but to cytoplasmic organelles (Seeger and Wolz, 1990).
- Mitochondrial dysfunction and changes in cytochrome oxidase have also been reported by other cancer researchers (Sharp et al., 1992; Modica-Napolitano et al., 2001)
- Seeger's findings after over 50 years of cancer research are: that cells become more electronegative in the course of cancerization, that *membrane degeneration* occurs in the initial phase of carcinogenesis first in the external cell membrane and then in the inner mitochondrial membrane, that the degenerative changes in the surface membrane causes these *membranes to become more permeable to water-soluble substances* so that potassium, magnesium, calcium migrate from the cells and sodium and water accumulate in the cell interior, that the degenerative changes in the inner membrane of the mitochondria causes *loss of anchorage of critical mitochondrial enzymes*, and that the mitochondria in cancer cells degenerate and are reduced in number (Seeger and Wolz, 1990).
- Numerous toxins have been identified that are capable of causing cancerous transformation. Many toxins not only cause genetic abnormalities, but also affect the structure and function of the cell membrane and the mitochondria.
- Toxic compounds that disrupt the electrical potential of cell membranes and the structure of mitochondrial membranes will deactivate the electron transport chain and disturb oxygen-dependent energy production. Cells will then revert to fermentation, which is a less efficient primeval form of energy production. According to Seeger the conversion to glycolysis secondary to the deactivation of the electron transport chain has a profound effect on the proliferation of tumor cells. Seeger believes that the virulence of cancer cells is inversely proportional to the activity of the respiratory chain. Conversion to glycolysis as a primary mechanism for energy production results in excessive accumulation of organic acids and pH alterations in cancerous tissues (Seeger and Wolz, 1990).

The body is an electrical machine and the matrix of cells that compose the body possess electrical properties.

- Among the electrical properties that cells manifest are the ability to conduct electricity, create electrical fields and function as **electrical generators** and **batteries**. This sounds like the basis of a good science fiction movie. ***(A movie or SciFi story may be best way to present this information to the public and medical community..There have already been a few attempts at this!….J.Beal)***
- In electrical equipment the electrical charge carriers are electrons. In the body electricity is carried by a number of mobile charge carriers as well as electrons. Although many authorities would argue that electricity in the body is only carried by charged ions, Robert O. Becker and others have shown that electron semiconduction also takes place in biological polymers (Becker and Selden, 1985; Becker, 1990).
- **The major charge carriers of biological organisms** are negatively charged electrons, positively charged hydrogen protons, positively charged sodium, potassium, calcium and magnesium ions and negatively charged anions particularly phosphate ions. The work of Mae Wan Ho and Fritz Popp indicate that cells and tissues also conduct and are linked by electromagnetic phonons and photons (Ho, 1996).

- The body uses the exterior cell membrane and positively charged mineral ions that are maintained in different concentrations on each side of the cell membrane to create a **cell membrane potential** (a voltage difference across the membrane) and a strong electrical field around the cell membrane. This electrical field is a readily available source of energy for a significant number of cellular activities including membrane transport, and the generation of electrical impulses in the brain, nerves, heart and muscles (Brown, 1999). The storage of electrical charge in the membrane and the generation of an electrical field create a battery function so that the liquid crystal semiconducting cytoskeletal proteins can in a sense plug into this field and power up cell structures such as genetic material. The voltage potential across the membrane creates a surprisingly powerful electric field that is 10,000,000 volts/meter according to Reilly and up to 20,000,000 volts/meter according to Brown (Reilly, 1998; Brown, 1999).
- The body uses the mitochondrial membrane and positively charged hydrogen ions to create a strong membrane potential across the mitochondrial membrane. Hydrogen ions are maintained in a high concentration of the outside of the mitochondrial membrane by the action of the electron transport chain, which creates a mitochondrial membrane potential of about 40,000,000 volts/meter. When this proton electricity flows back across the inner mitochondrial membrane it is used to power a **molecular motor** called ATP syntase, which loads negatively charged phosphate anions onto ADP thus creating ATP (Brown, 1999).
- ADP, ATP and other molecules that are phosphate carriers are electrochemical molecules that exchange phosphate charges between other cellular molecules. According to Brown, “The flow of phosphate charge is not used to produce large-scale electrical gradients, as in conventional electricity, but rather more local electrical field within molecules (Brown, 1999).” The body uses phosphate electricity to activate and deactivate enzymes in the body by charge transfer, which causes these enzymes to switch back and forth between different conformational states. So in a sense enzymes and other types of proteins such as cytoskeletal proteins may function as **electrical switches**.
- **The liquid crystal proteins that compose the cytoskeleton** support, stabilize and connect the liquid crystal components of the cell membrane with other cell organelles. The cytoskeletal proteins have multiple roles.
- The proteins that compose the cytoskeleton serve as *mechanical scaffolds* that organize enzymes and water, and anchor the cell to structures in the extracellular matrix via linkages through the cell membrane (Wolfe, 1993). According to Wolfe, “Cytoskeletal frameworks also reinforce the plasma membrane and fix the positions of junctions, receptors and connections to the extracellular matrix (Wolfe, 1993).”
- Self-assembling cytoskeletal proteins are dynamic network structures that create a fully integrated electronic and probably fiberoptic *continuum* that links and integrates the proteins of the extracellular matrix with the cell organelles (Haltiwanger, 1998; Oschman, 2000).
- Cytoskeletal proteins also structurally and electronically link the cell membrane with cell organelles.
- **Cytoskeletal proteins are altered in cancer cells.** Alterations include: *reversion to arrangements typical of embryonic cells,* and breakage of contact and connections with ECM and neighboring cells. *It is my opinion that change of connections of the cytoskeletal proteins with ECM components and the cell membrane will disrupt the flow of inward current into the cell, affect genetic activity and is an important factor in disabling oxygen-dependent energy production.*

- Cells can obtain energy from food either by fermentation or oxygen-mediated cellular respiration. Both methods start with the process of glycolysis, which is the splitting of glucose (6 carbon) into two molecules of pyruvate (3 carbon).
- Most biologists believe that glycolysis, the oldest metabolic way to produce ATP, has been conserved in all living organisms. Glycolysis happens in the cytoplasm and does not require oxygen in order to produce ATP, but it is also a much less efficient method than aerobic respiration.
- The enzyme pyruvate dehydrogenase occupies a pivotal role in determining whether energy is extracted from glucose by aerobic or anaerobic methods (Garnett, 1998). This enzyme exists in an altered form in cancer cells (Garnett, 1998). *Overall membrane changes, mitochondrial dysfunction, loss of normal cellular electronic connections and enzyme changes are all factors that contribute to the permanent reliance of cancer cells on glycolysis for energy production.*

Electronic roles of the cell membrane and the electrical charge of cell surface coats:

- **Cell membrane potential** - All cells possess an electrical potential (a membrane potential) that exists across the cell membrane. **Why is this so?**
- Cell membranes are composed of a bilayer of highly mobile lipid molecules that electrically act as an insulator (dielectric). The insulating properties of the cell membrane lipids also act to restrict the movement of charged ions and electrons across the membrane except through specialized membrane spanning protein ion channels (Aidley and Stanfield, 1996) and membrane spanning protein semiconductors (Oschman, 2000) respectively.
- Because the cell membrane is selectively permeable to sodium and potassium ions a different concentration of these and other charged mineral ions will build up on either side of the membrane. The different concentrations of these charged molecules cause the outer membrane surface to have a relatively higher positive charge than the inner membrane surface and creates an electrical potential across the membrane (Charman, 1996). All cells have an imbalance in ***electrical charges*** between the inside of the cell and the outside of the cell. The difference is known as the membrane potential.
- Because the membrane potential is created by the difference in the concentration of ions inside and outside the cell this creates an electrochemical force across the cell membrane (Reilly, 1998). “Electrochemical forces across the membrane *regulate chemical exchange across the cell* (Reilly, 1998).” The cell membrane potential helps **control cell membrane permeability** to a variety of nutrients and helps turn on the machinery of the cell particularly energy production and the synthesis of macromolecules.
- All **healthy living cells** have a membrane potential of about -60 to –100mV. The negative sign of the membrane potential indicates that the inside surface of the cell membrane is relatively more negative than the immediate exterior surface of the cell membrane (Cure, 1991). In a healthy cell the inside surface of the cell membrane is slightly negative relative to its external cell membrane surface (Reilly, 1998). When one considers the transmembrane potential of a healthy cell the electric field across the cell membrane is enormous being up to 10,000,000 to 20,000,000 volts/meter (Reilly, 1998; Brown, 1999).
- Healthy cells maintain, inside of themselves, a high concentration of potassium and a low concentration of sodium. But when cells are injured or cancerous **sodium and water flows in to the cells** and potassium, magnesium, calcium and zinc are lost from the cell interior and the cell membrane potential falls (Cone, 1970, 1975, 1985; Cope, 1978).

- In writing this monograph I found that trying to describe what factors are primary and result in other changes was like arguing over whether the chicken came before the egg or vice versa. What is known is that in cancer changes in cell membrane structure, changes in membrane function, changes in cell concentrations of minerals, changes in cell membrane potential, changes in the electrical connections within the cells and between cells, and changes in cellular energy production all occur. Before I continue to explore these issues I want to discuss the electrical zones of the cell.

Cells actually have a number of discrete electrical zones.

- For years I have been frustrated when I read papers and books that discussed the electrical properties of cells. It was not until I read Roberts Charman's work that I began to understand that the electrical properties of a cell vary by location.
- According to Charman **a cell contains four electrified zones** (Charman, 1996). The *central zone* contains negatively charged organic molecules and maintains a steady bulk negativity. An *inner positive zone* exists between the inner aspect of the cell membrane and the central negative zone. The inner positive zone is composed of a thin layer of freely mobile mineral cations particularly potassium and according to Hans Nieper (Nieper, 1985) a small amount of calcium as well. The *outer positive zone* exists around the outer surface of the cell membrane and consists of a denser zone of mobile cations composed mostly of sodium, calcium and a small amount of potassium. Because the **concentration of positive charges is larger on the outer surface of the cell membrane than the concentration of positive charges on the inner surface of the cell membrane an electrical potential exists across the cell membrane.** You might ask at this point the question, **how can the surface of cells be electrically negative if a shell of positively charged mineral ions surrounds the exterior surface of the cell membrane?** The answer lies in the existence of an outer electrically negative zone composed of the glycocalyx.
- The *outermost electrically negative zone* is composed of negatively charged sialic acid molecules that cap the tips of glycoproteins and glycolipids that extend outward from the cell membrane like tree branches. The outermost negative zone is separated from the positive cell membrane surface by a distance of about 20 micrometers. According to Charman, "It is this outermost calyx zone of steady negativity that makes each cell act as a negatively charged body; every cell creates a negatively charged field around itself that influences any other charged body close to it (Charman, 1996)."
- It is the negatively charged sialic acid residues of the cell coat (glycocalyx) that gives each cell its **zeta potential**. Since the negatively charged electric field around cells are created by sialic acid residues, any factor that increases or decreases the number of sialic acid residues will change the degree of surface negativity a cell exhibits. I will discuss later in this paper how cancer cells have significantly more sialic acid molecules in their cell coat and as a result cancer cells have a greater surface negativity. *In my opinion one of reasons that enzyme therapy is beneficial in cancer is because certain enzymes can remove sialic acid residues from cancer cells reducing their surface negativity.*

The electrical properties of cancer cells part 1

- Some of the characteristic features of cancerous cells that affect their electrical activity are:
    1. Cancer cells are less efficient in their production of cellular energy (ATP).
    2. Cancer cells have cell membranes that exhibit different electrochemical properties and a different distribution of electrical charges than normal tissues (Cure, 1991. 1995).

3. Cancer cells also have different lipid and sterol content than normal cells (Revici, 1961).
4. Cancer cells have altered membrane composition and membrane permeability, which results in the movement of potassium, magnesium and calcium out of the cell and the accumulation of sodium and water into the cell (Seeger and Wolz, 1990).
5. Cancer cells have lower potassium concentrations and higher sodium and water content than normal cells (Cone, 1970, 1975; Cope, 1978).

- The result of these mineral movements, membrane composition changes, energy abnormalities, and membrane charge distribution abnormalities is a drop in the normal membrane potential and membrane capacitance. I will now discuss these features in more depth.
- One of the characteristic features of injured and cancerous cells is that they are **less efficient in their production of cellular energy** (ATP). One of the mysteries of cancer is whether energy abnormalities cause or contribute to the mineral alterations or whether mineral alterations and membrane changes cause or contribute to the energy abnormalities by disrupting mitochondrial production of ATP. But all these abnormalities are present and in my opinion all of them should be addressed by therapeutic strategies.
- A *change in mineral content of the cell,* particularly an increase in the intracellular concentration of positively charged sodium ions and an *increase in negative charges on the cell coat* (glycocalyx) are two of the major factors causing **cancerous cells to have lower membrane potential** than healthy cells (Cure, 1991).
- Cancer cells exhibit both *lower electrical membrane potentials and lower electrical impedance* than normal cells (Cone, 1985; Blad and Baldetorp, 1996; Stern, 1999).
- Since the membrane potential in a cancer cell is consistently weaker than the membrane potential of a healthy cell. The electrical field across the membrane of a cancer cell will be reduced. The reduction in membrane electrical field strength will in turn cause alterations in the metabolic functions of the cell.
- In the resting phase normal cells maintain a high membrane potential of around -60mv to -100mv, but when cells begin cell division and DNA synthesis the membrane potential falls to around –15mv (Cure, 1995). When a cell has completed cell division its membrane potential will return back to normal.
- According to Cone two of the most outstanding electrical features of cancer cells is that they **constantly maintain** their membrane potential at *a low value* and their intracellular *concentration of sodium at a high concentration* (Cone, 1970, 1975, 1985).
- Cone has discussed in his publications that a sustained elevation of intracellular sodium may act as a **mitotic trigger** causing cells to go into cell division (mitosis) (Cone, 1985).
- It is generally thought that a *steady supply of cellular energy* and a healthy cell membrane are needed to maintain a normal or healthy concentration of intracellular minerals and a healthy membrane potential. This means that conditions associated with **disruption of cellular energy production** and **membrane structure/function** will result in *changes in the intracellular mineral concentration and a low membrane potential.*

- This statement may be true for injured cells, but Cure has proposed that another additional factor may be involved in changing the cell membrane potential of cancer cells, the concentration of sodium and potassium inside of cancer cells, and the mechanisms that cancer cells use to produce energy.
- Cure has proposed that the accumulation of an **excessive amount of negative charges on the exterior surface of cancer cells** will depolarize cancer cell membranes. He thinks that the depolarization (fall in membrane potential) of the cancer cell membrane due to the accumulation of excess negative surface charges may **precede and create** the reduction in intracellular potassium and the rise in the intracellular sodium launching the cell into a carcinogenic state (Cure, 1991). I know this must read like I am splitting hairs, but if the creation of an excessive negative charge on the surface of a cell can initiate a carcinogenic change then it means **genetic changes can result from the development of cellular electrical abnormalities**.
- This has profound implications because it would mean that the development of genetic abnormalities is not always the prime factor leading to cancerous transformation.
- Cure's theory ties into Dr. Paul Gerhardt Seeger's work **that cancer arises from alterations in the functions of cell organelles outside of the nucleus** (Seeger and Wolz, 1990).
- This idea may mean that certain chemicals, viruses and bacteria create cancers by **modifying the electrical charge of the cell surface** resulting in alterations in: cell membrane and organelle membrane electrical potentials, the functions of these membranes, intracellular mineral content, energy production and genetic expression.
- It also means that therapeutic methods that manipulate the electrical charge of cell membranes, the composition of cell membranes and the content of intracellular minerals can result in alterations in genetic activity.
- A healthy cell membrane potential is strongly linked to the control of cell membrane transport mechanisms as well as DNA activity, protein synthesis and aerobic energy production. Since injured and cancerous cells cannot maintain a normal membrane potential they will have electronic dysfunctions that will impede repair and the reestablishment of normal metabolic functions. Therefore a **key component of cell repair and cancer treatment** would be to reestablish a healthy membrane potential in the body's cells (Nieper, 1966a, 1966b, 1966c, 1967a, 1967b, 1968, 1985; Alexander, 1997b; Nieper et al., 1999).

The electrical properties of cancer cells part 2

- The idea of classifying cancers by their electrical properties is not a new idea in fact it was first proposed by Fricke and Morse in 1926 (Fricke and Morse, 1926). For example, the electrical conductivity and permittivity of cancerous tissue has been found to been found to be greater than the electrical conductivity and permittivity of normal tissues (Foster and Schepps, 1981). Because cancerous cells demonstrate greater permittivity, which is the ability to resist the formation of an electrical field they **will resonate differently from normal cells**.
- **The electrical conductivity** of a tissue depends on both the physico-chemical bulk properties, i.e., properties of tissue fluids and solids and the microstructural properties, i.e., the geometry of microscopic compartments (Scharfetter, 1999). In turn the electrical **conductivity** and **permittivity** of biological materials will vary characteristically *depending on the frequency applied* (Scharfetter, 1999).

- In biological tissues electrical currents are carried by both ionic conduction and electron semiconduction. Whereas in electrical equipment only electrons or electron holes carry the electrical current. Therefore the electrical properties of biological tissues are dependent on all the physical mechanisms, which control the mobility and availability of the relevant ions such as sodium, chloride, potassium, magnesium and calcium (Scharfetter, 1999).
- The electrical charges associated with semiconducting proteins and extracellular matrix proteoglycans also contribute to the conductivity of a tissue. So the electrical properties of tissues also relates to electron availability, which can be affected by such factors as the degree of tissue acidity, the degree of tissue hypoxia, the degree that water is structured, and the availability of electron donors such as antioxidants, and the presence of electrophilic compounds on the cell membrane and in the extracellular matrix (ECM).
- The cell membrane ECM interface is the location where molecules like hormones, peptide growth factors, cytokines, and neurotransmitters initiate chemical signaling from cell to cell and where these chemical-signaling events can be **regulated and amplified** by the weak nonionizing oscillating electromagnetic fields that are naturally present in the ECM (Adey, 1988). The cell membrane ECM interface has a lower electrical resistance than the cell membrane so *electrical currents will be preferentially conducted* through this space (Adey, 1981). This cell surface current flow is involved in controlling many of the physiological functions of the cells and tissues (Adey, 1981).
- Conductivity in both healthy tissues and cancerous tissues can be affected by variations in: temperature, oxygen levels, mineral concentrations in intracellular and extracellular fluid, the types of minerals present in intracellular and extracellular fluids, pH (both intracellular and extracellular), level of hydration (cell water content and extracellular water content), the ratio of structured/unstructured water inside of the cell, membrane lipid/sterol composition, free radical activity, the amount of negative charges present on the surface of cell membranes, the amount and structure of hyaluronic acid in the ECM, the emergence of endogenous electrical fields, the application of external electromagnetic fields, and the presence of chemical electrophilic toxins and heavy metals both within the cell and in the ECM.
- According to Dr. Robert Pekar, "**Every biological process is also an electric process**" and "health and sickness are related to the bio-electric currents in our body (Pekar, 1997)."
- The electrical properties of cancer cells are different than the electrical properties of the normal tissues that surround them. From the papers that I have read in preparing this monograph many authors have reported that cancer cells have higher intracellular sodium, higher content of unstructured water, lower intracellular potassium, magnesium and calcium concentrations, and more negative charges on their cell surface (Hazelwood et al., 1974; Cone, 1975; Cope, 1978; Brewer, 1985, Cure, 1991). These abnormalities result in cancer cells having lower transmembrane potentials than normal cells and altered membrane permeability. These cell membrane changes interfere with the flow of oxygen and nutrients into the cells and impair aerobic metabolism causing cancer cells to rely more on anaerobic metabolism for energy production. Anaerobic metabolism, excessive sodium concentrations, low transmembrane potential and pH alterations in turn create intracellular conditions more conducive to cellular mitosis.
- Recognizing that cancer cells have altered electrical properties also leads to strategies toward correcting these properties.
- Some of the areas to explore are:
    1. Manipulation of fatty acids and sterols to address membrane composition.

2. Methods to reduce intracellular sodium concentrations, since an intracellular excess of positively charged sodium ions **reduces** the negative interior potential of the inner membrane surface resulting in a fall in membrane potential.
3. Use of compounds like mineral transporters to increase intracellular delivery of magnesium, potassium and calcium.
4. Methods that can help remove the silaic acid and excessive negative charges from the external surface of cancer cells (glycocalyx) such as enzymes and electrical treatments. Since an excess of negative charges in the glycocalyx also can reduce the membrane potential of cancer cells.
5. Manipulating electrical charges on both sides of tumor cell membranes.
6. **Corrective intracellular, extracellular and membrane measures** can be used to address the abnormal electrical properties of cancer cells. **Intracellular measures** could include the use of intracellular potassium and magnesium mineral transporters and the amino acid taurine to reestablish more normal intracellular levels of these minerals inside of the cell. Calcium aspartate can be used to deposit calcium on the inner side of the cell membrane. **Extracellular measures** could include the use of calcium 2-AEP to lay down a shell of positive calcium ions on the surface of cells to neutralize the negative surface charges. Also enzymes and antihCG vaccines can reduce the number of negatively charged sialic acid residues on the surface of cancer cells. **Cell membrane measures** could include use of squalene to improve sodium excretion form the cell and oxygen entry into the cells.
7. **In summary.** Improved cell membrane potential and membrane capacitance will affect: mitochondrial production of ATP, cell membrane permeability, production of proteins and other macromolecules. Certain nutrients have the ability to support the electrical potential of the cell membrane. These nutrients include essential fatty acids, phospholipids, sterols and nutrients such as mineral transporters that help normalize intracellular mineral concentrations in diseased cells. The combination of cell membrane repair and correction of deficiencies of intracellular mineral concentrations primarily potassium, magnesium, zinc and calcium and correction of excessive intracellular levels of sodium will result in improvement of cell membrane capacitance back toward a healthier charge. Mineral transporters such as orotates, arginates and aspartates can be used to adjust intracellular mineral concentrations. **Some clinicians also try to improve the cellular capacitance of cancer cells by use of PEMF, microcurrent, infrared and phototherapy equipment.**

Anatomical concepts

Tissue cells exist within a continuum where they are attached to other cells of the same type. The cells of the body require a steady supply of nutrients so they are typically located in close proximity to blood vessels. The extracellular matrix occupies an intermediate position between the blood vessels and the cell membrane. The major anatomical areas I will examine are:

1. The intravascular space and its components
2. The cell membrane covering of cells and the attached glycocalyx
3. The extracellular space and the components of the extracellular matrix
4. The ECM-glycocalyx-membrane interface

The intravascular space and its components has many functions including nutrient transport into the cell, toxin transport away from the cells and a control function where soluble hormones and growth stimulants and inhibitors are carried to cells from distant locations and away from secreting cells to distant locations.

The cell membrane covering of all cells and the attached glycocalyx: Chemical and anatomical roles of the cell membrane.

- The cell membrane is the gatekeeper of the cell that controls the inflow and outflow of nutrients and electric currents to and from the cell interior. It regulates the active transport of nutrients such as minerals and amino acids, and the release of toxins.
- The cell membrane is an interface between the cell interior, other cells and components of the extracellular matrix (ECM). The cell membrane mediates adherence and communication with other cells, the ECM and components of the immune system.
- Normal multicellular organisms require coherent and coordinated communication of each cell with the other cells in the organism. In order to synchronize cellular processes in a multicellular state *a communication system must exist*.
- For most of the last century biological science has concentrated almost exclusively on explaining the communication system of multicellular organisms with vascular systems by focusing on circulatory chemical signals carried by the bloodstream to other areas of the body. This paradigm attributes communication at the cellular levels to molecular interactions, chemical concentrations and chemical kinetics.
- The cell membrane contains docking ports on its surface called receptors that allow the cell to pick up distant chemical signals (hormones, neurotransmitters, prostagladins) sent by other cells through the blood stream and local chemical signals generated by components of the ECM and immune cells. *I will discuss later in this monograph that it is likely that many of these cell receptors also function as antennas for particular frequencies of electromagnetic energy (Haltiwanger, 1998).*
- The cell membranes of cancer cells are different from normal cells. Cancer cell membranes have alterations in their lipid/sterol content (Revici, 1961) and in the types of glycoproteins and antigens that they express (Warren et al., 1972; Hakomori, 1990). Cancer cells also exhibit the ability to express their own growth factors and the ability to ignore growth factor inhibition control exerted by the ECM.

The extracellular space and the components of the extracellular matrix connect to the cytoskeleton of the cells

- The ECM occupies an intermediate space between the intravascular space and the boundary of the cells. The ECM can be considered to function as a prekidney, since all substances that have to be eliminated through the bloodstream and kidneys must first pass through the ECM. The ECM is also a transit and storage area for nutrients, water, and waste.
- The ECM pervades the entire organism and reaches most cells in the body. The ECM has anatomic, physical, chemical, and electronic functions.
- **Anatomically** the ECM consists of a recticulum consisting of polymeric protein-sugar complexes bound to water forming a gel state (Oschman, 2000). The cytoplasm inside of cells also exists in a gel state. The liquid crystal properties of the molecules in these compartments allow them to undergo cooperative phase transitions in response to changes in temperature, pH, ion concentrations, oxygen concentration, carbon dioxide concentration, ATP concentration, electrical fields and other physical factors.

- Cells are organized structures with an internal architecture of cytoskeletal proteins that connect all components of the cell. The enzymes of the cell are attached to the cytoskeletal framework and membranes creating solid-state chemistry (Ho, 1996). Enzymes are not just floating randomly around. Cytoskeletal filaments and tubules form a continuous system that links the cell surface to all organelle structures including passage through the nuclear membrane to the chromosomes. The cytoskeleton is also attached through cell membrane connectors to liquid crystal protein polymers located in the external ECM and to other cells.
- The liquid crystal protein polymers of the ECM are mostly composed of collagen, elastin, hylauronic acid, and interweaving glycoproteins such as fibronectin. Fibronectins binds the ECM proteins to each other and to cell membrane integrins. The cell membranes contain proteins called integrins, which creates a continuum linking the internal liquid crystal cytoskeletal proteins to liquid crystal proteins located outside of the cell in the ECM (Oschman, 2000).
- When cells become swollen with water (injured cells and cancerous cells) the cell geometry changes, which will create different connections, different electron and photon flows, different chemistry, and different pH.
- Cancer cells have different cytoskeletal structures, different fat/sterol content of their membranes, different enzymes, and different proteins and cell membrane receptors due to genetic alterations.
- Some of the proteins of cancer cells are regressive reversions to embryological proteins, which creates different binding = loss of connectedness, and different chemistry esp. in energy production. The regressive reversions of cancer cells causes these cells to express different extracellular matrix material creating a more negative charge on the exterior of cancer cells, an alteration in the ionic content inside of cancer cells, and a different interaction with the environment.
- **Physically the ECM** acts as a **molecular sieve** between the capillaries and the cells (Reichart, 1999). The concentration of minerals in the ECM, the composition of proteoglycans, the molecular weight of the proteoglycans, the amount of bound water in the ECM, and the pH of the ECM control the filtering aspect of the ECM.
- The ECM is **a transit area** for the passage of nutrients from the bloodstream into the cells and for toxins released by the cells that pass through to the bloodstream. It is also a transit area for immune cells that move out of the bloodstream. These immune cells are involved in inflammatory reactions by secreting cytokines and digesting old worn out cells. They may also facilitate healing by carrying and delivering components from other areas of the body to the cell membrane. These migrating immune cells, as well as fixed cells in the ECM, regulate cellular functions by secreting growth factors and cell growth inhibitors (Reichart, 1999).
- The ECM functions as **a storage reservoir** for water, nutrients and toxins and a pH buffering system where the proteins of the ECM buffer acids released by the cells.
- In healthy conditions most of the water in the ECM is bound to the interweaving proteoglycans forming a gel, which creates a physical barrier that limits, directs, and evenly distributes the flow of fluid from the venule end of the capillaries to the cells.
- When conditions create edema in the ECM. Fluid flows more easily from leaky capillaries, but these large flows of fluid are unevenly distributed, which interferes with nutrient delivery, oxygen perfusion and waste disposal. In edematous conditions the ECM becomes more hypoxic, more acidic and electrically more resistant. Bioflavinoids are some of the most effective nutrients in reducing capillary leakage, which helps reduce edema. In a sense bioflavinoids could be considered to be electrical

nutrients because they can help improve the electrical conductivity of the ECM by helping reduce capillary leakage and ECM edema.

- **Biochemically the ECM** is a metabolically and electrically active space that is involved in regulating cell growth control. Cellular components of the ECM are involved in the local production of growth factors, growth inhibitors and cytokines that affect the growth and metabolic activity of tissue/organ cells (Reichart, 1999). Immune cells such as leukocytes, lymphocytes and macrophages that migrate into the ECM are involved in initiating the removal of old and damaged cells and in stimulating the growth of new cells.
- Fibroblasts and fibrocytes are the main cells that produce the proteins and ground substance of the ECM in soft tissue.
- The glycocalyx (sugar cell coat) is produced by the cells of parenchymal organs and secreted onto their cell surfaces. The ECM and the glycocalyx work together to regulate information transfer to and from tissue/organ cells by both electrical field fluctuations leading to electroconformational coupling and soluble signaling molecules.
- **Electronic functions of the ECM:** According to James Oschman, communication systems in living organisms involve two languages chemical and energetic (Oschman, 2000). Chemical communication in the body takes place mainly through the circulatory system. Energetic communication in the body, according to Western Medical paradigms, takes place almost exclusively in the nervous system. Oschman and Mae Wan Ho (Ho, 1998) have written extensively about an evolutionarily older solid-state electronic communication system that operates both in series and in parallel with the nervous system through the liquid crystal protein polymer connective system continuum. It is through this continuum that information is carried in biological systems via endogenous DC electric fields, their associated magnetic fields and ultra-weak photon emission.
- This continuum of liquid crystal connections will allow electrons and photons to move in and out of cells. In my opinion cytoskeletal filaments **function as electronic semiconductors and fiberoptic cables** integrating information flow both within the cell and with other cells. This continuum enables an organism to function as a biological hologram.
- In my opinion the extracellular connective system is an unrecognized organ that is spread diffusely throughout the body. In medicine doctors are trained to think of organs as discrete tissues that have particular anatomical locations, but I see the connective tissues as a specialized organ that integrates all parts of the body into a holographic matrix where each organ even each cell is in communication with all other parts. But what about circulating vascular cells and migrating immune cells? They are not attached to connective tissue fibers, how do they communicate? I believe these cells communicate both by chemical and resonant interactions. I believe that energetic communications in the body takes place through hard wired biologic electronic systems, biologic fiberoptic systems as well as through resonant interactions.

The electronic functions of the cells and the ECM are involved in healing and tissue regeneration.

- **Cells are electromagnetic in nature**, they generate their own electromagnetic fields and they also harness external electromagnetic energy of the right wavelength and strength to communicate, control and drive metabolic reactions.
- The cells of an organism are embedded in a matrix of organized water and most of the body's cells are hardwired into a holographic liquid crystal polymer continuum that connects the cytoskeletal elements of the inside of the cell through cell membrane structures with a **semiconducting** and **fiberoptic liquid crystal polymer** connective tissue communication system (Haltiwanger, 1998; Oschman, 2000).

- Most of the molecules in the body are **electrical dipoles** (Beal, 1996). These dipoles electronically *function like transducers* in that they are able to turn ***acoustic waves into electrical waves and electrical waves into acoustic waves*** (Beal, 1996). The natural properties of biomolecular structures enables cell components and whole cells to oscillate and interact resonantly with other cells (Smith and Best, 1989). According to Smith and Best, the cells of the body and cellular components possess the ability *to function as electrical resonators* (Smith and Best, 1989).
- Professor H. Frohlich has predicted that the fundamental oscillation in cell membranes occurs at frequencies of the order of 100 GHz and that biological systems possess the ability to create and utilize coherent oscillations and **respond to external oscillations** (Frohlich, 1988). Lakhovsky predicted that cells possessed this capability in the 1920's (Lakhovsky, 1939).
- Because cell membranes are composed of dielectric materials a cell will behave as dielectric resonator and will produce an evanescent electromagnetic field in the space around itself (Smith and Best, 1989). "This field does not radiate energy but is capable of interacting with similar systems. Here is the mechanism for the electromagnetic control of biological function (Smith and Best, 1989)." *In my opinion this means that the applications of certain frequencies by frequency generating devices can enhance or interfere with cellular resonance and cellular metabolic and electrical functions.*
- **Electric fields** induce or cause alignment in dipole movements. A dipole movement is a function of polarization processes and the strength of the electric field. When biological tissue is exposed to an electric field in the right frequency and amplitude **windows** a preferential alignment of dipoles becomes established. Since the cell membrane contains many dipole molecules, an electric field will cause preferential alignment of the dipoles. This may be one mechanism that electrical fields alter membrane permeability and membrane functions.
- Both internally generated and externally applied electromagnetic fields can affect cell functions. The primary external electromagnetic force is the sun, which produces a spectrum of electromagnetic energies. Life evolved utilizing processes that harness the energy of light to produce chemical energy, so in a sense light is the first nutrient.
- Endogenous weak electric fields are naturally present within all living organisms and apparently involved in pattern formation and regeneration (Nuccitelli, 1984).
- Regeneration is a healing process where the body can replace damaged tissues. Some of the most important biophysical factors implicated in tissue repair and regeneration involve the natural electrical properties of the body's tissues and cells (Brighton et al., 1979), such as cell membrane potential and protein semiconduction of electricity. The body utilizes these fundamental bioelectronic features to naturally produce electrical currents that are involved in repair and regeneration (Becker, 1961, 1967, 1970, 1972, 1974, 1990). Robert O. Becker has shown in his research that the flow of endogenous electrical currents in the body is not a secondary process, but in fact is an initiator and control system used by the body to regulate healing in bone **and other tissues** (Becker, 1970, 1990; Becker and Selden, 1985).
- For example, in bone the proper production and conduction of endogenous electrical currents is required to stimulate primitive precursor cells to differentiate into osteoblasts and chondroblasts (Becker and Selden, 1985; Becker, 1990). Once the bone forming osteoblasts are created, they *must maintain a healthy cell membrane electrical potentia*l and have available certain critical nutrients in order to form the polysaccharide and collagen components of osteoid. Endogenous bone electrical currents created through piezoelectricity (Fukada, 1957, 1984) are also required for deposition of calcium crystals (Becker et al., 1964).

When the biophysical electrical properties of the tissues are considered, it makes sense to develop therapeutic strategies that support the body's biophysical electrical processes to potentiate the healing of injured, diseased, and cancerous tissues.

The ECM-glycocalyx-membrane interface

- **Cell membranes are composed of** phospholipids, sterols and embedded and attached proteins. The composition of the cell membrane directly affects cell *membrane functions* include membrane permeability, cell signaling, and cell capacitance.
- **Glycoproteins** secreted from the cell interior and cellular components of the ECM create the glycocalyx covering of cells. Some of these glycoproteins are components of cell membrane receptors making them important in signaling processes such as activation by growth factors.
- These glycoproteins characteristically have a negative electrical charge. Cancer cells however have excessively high concentrations of negatively charged molecules on their exterior surface, which act as electric shields (Cure, 1991, 1995).
- Cell membrane glycoproteins act as molecular chemical receptors and electromagnetic or electric field antennas (Adey, 1988). If Adey is right then cells function both as chemical and *electrical receivers and transmitters* .

Signaling mechanisms may be either chemically or resonantly mediated.

- **Chemical communication** is mediated by chemical soluble signals that travel through the bloodstream and then through the ECM from distant locations or chemicals that are locally produced in the ECM. These soluble signaling molecules may be produced in distant sites by endocrine cells or are secreted by cells embedded within the ECM or cells that migrate into the ECM such as macrophages, T-cells and B-cells. When these soluble signaling molecules are presented to the organ cells they can either activate or inhibit cellular metabolic reactions by activating cell membrane or cytoplasmic glycoprotein receptors (Reichart, 1999).
- Chemical signal activation of cell receptors will cause the receptor's molecular structure to shift from an inactive to an activated conformational state. This is a phase transition. When a receptor is activated it will bind to and activate other membrane bound proteins or intracellular proteins/enzymes. The outcome of receptor activation may: increase the transport of certain molecules or mineral ions from one side of the cell membrane to the other side; increase or inhibit the activity of enzymes involved in metabolic synthesis or degradation; activate genes to produce certain proteins; turn off gene production of other proteins or cause cytoskeletal proteins to change the shape or motility of the cell. When the receptor protein switches back to its inactive conformation it will detach from the effector proteins/enzymes and the signal will cease (Van Winkle, 1995).
- **Cell receptors can also be activated by electric fields** (vibrational resonance) that have particular frequencies and amplitudes through a process known as *electroconformational coupling* (Tsong, 1989). Electrical oscillations of the right frequency and amplitude can alter the electrical charge distribution in cell receptors causing the cell receptors to undergo conformational changes just as if the receptor was activated by a chemical signal. Ross Adey has extensively described in his publications **that the application of weak electromagnetic fields of certain windows of frequency and intensity act as first messengers** by activating glycoprotein receptors in the cell membrane (Adey, 1993). This electrical property of cell receptor- membrane

complexes would allow cells to scan incoming frequencies and tune their circuitry to allow them to resonate at particular frequencies (Charman, 1996).

- Adey and other researchers have reported that one effect of the application of weak electromagnetic fields is the release of calcium ions inside of the cell (Adey, 1993). Adey has also documented that cells respond constructively to a wide range of frequencies including frequencies in the extremely low frequency (ELF) range of 1-10 Hz a range of frequencies known as the Schumann resonance frequencies that are naturally produced in the atmosphere (Adey, 1993).
- Adey has also reported that certain frequency bands between 15-60 Hz have been **found to promote cancers**. Frequencies in this range have been found to alter cell protein synthesis, mRNA functions, immune responses and intercellular communication (Adey, 1992).The ECM also contains nerve fibers connected through the autonomic nervous system back to the brain, which then regulates hormone homeostasis by feedback control through the hypothalamic pituitary axis.

Resonance communication mechanisms

- The ground substance of the ECM contains an electrical field that will fluctuate in response to the composition of proteoglycans especially the degree of negative charge, which is dependent on the concentration of sialic acid residues and the ion/mineral content of the ECM. The fluctuations/oscillations of the electric field of the ECM, when strong enough, can lead to local depolarization of portions of the cell membrane and changes in membrane permeability.
- The oscillation of the electrical potential can affect through resonance (electrochemical coupling) the conformational structures of cell membrane receptors. The receptors can switch back and forth between conformations, which will lead to turning on the activity of membrane embedded enzymes and opening and closing ion channels.
- Electrical field fluctuations that occur in the ECM and these field fluctuations are involved in cell signaling mechanisms. A number of researchers such as Becker and Adey believe that natural weak endogenous electric fields **actually control the chemical process of cell membrane signaling.** *This means that measures that enhance or disturb the production of these natural electric fields can impact cell-signaling processes.* In the future electrical medicine will advance to the point where you can dial up and administer frequencies that will act like pharmacological agents. When this occurs the phrase ‘beam me up Scottie’ may take on a whole new meaning.
- The natural oscillating electrical potential of the ECM can be adversely affected or constructively supported by exposure to external electromagnetic fields. Adverse electromagnetic field exposure can be initiated by exposure to high power tension lines, transformers and electronic equipment such as cell phones. Constructive support includes use of *certain nutrients* and devices like infrared emitters, phototherapy equipment, multiwave oscillators and microcurrent equipment that emit electromagnetic fields and electrical currents in physiological ranges.
- **Acoustical (sound) waves** of the right frequency can also affect cell-signaling and cellular metabolic processes.

The Bioelectrical control system

- The body uses electricity (biocurrents) as part of the body’s mechanism for controlling growth and repair (Borgens et al., 1989). Some of these biocurrents travel through hydrated liquid crystal semiconducting protein-proteoglycan (collagen-hyaluronic acid) complexes of the ECM. Key elements that support this physiologic function include proper hydration, and

normal protein configurations, **which allow for the water to be structured in concentric nanometer thick layers** (Ling, 2001). The production of normal ECM components, and proper ion concentrations are also important.

- Healthy production of collagen and hyaluronic acid in the ECM is in turn dependent upon the interactions of: internal cellular machinery that produces proteins and sugars, especially proper reading of the genetic code; availability of construction material like amino acids such as lysine and proline that are needed for collagen production; intracellular availability of cofactors of protein and sugar producing enzymes such as zinc, magnesium, trace minerals, vitamin C, bioflavinoids and B-complex vitamins; and the availability of endogenously produced and ingested precursor molecules such as glucosamine, mannose, galactose etc.
- **Biocurrents in the ECM pass through the cell membrane into the cell and electrons produced in the cell also pass out through the cell membrane.**
- Dr. Merrill Garnett has spent four decades studying the role of charge transfer and electrical current flow in the cell (Garnett, 1998). Dr. Garnett believes that biological liquid crystal molecules and structures such as hyaluronic acid, prothrombin, DNA, cytoskeletal proteins and cell membranes are involved in maintaining both an inward and outward current. The inward current flows from the cell membrane to cell structures like mitochondria and DNA and the outward current flows back along liquid crystal semiconducting cytoskeletal proteins back through the cell membrane to the ECM.
- Dr. Garnett has reported that **all cancer cells have abnormal electron transfer** systems and that normal cell development involves normal energy flows (Garnett, 1998).
- Dr. Garnett believes that electrical charges stored in the cell membrane (capacitance) and electrical charges of oxygen free radicals are normally transferred to DNA and are involved in DNA activation and the creation of an electrical field around DNA. DNA is very effective in transferring large amounts of electrical charge along its long axis (Garnett, 1998). In fact new research shows that DNA molecules may be good **molecular semiconductors** (Li and Yan, 2001).
- Dr. Garnett believes that an electrical pathway from the cell membrane fats to DNA is a natural pathway, **related to development** in cells that use **aerobic mechanisms** of ATP production (Garnett, 1998). As a corollary this natural electrical pathway is *transiently disrupted* in healthy cells while they are involved in wound healing and permanently disrupted in cancer cells that rely on anaerobic glycolysis for energy production. He believes that cells that are transformed into cancer cells have highly altered energy metabolism that includes increased reliance on glycolysis and a shift to the use of glutamine in the TCA cycle (Garnett, 1998). Cancer cells and normal cells that are growing in hypoxic areas use anaerobic energy production pathways that are regressions to earlier stages of embryonic development, but unlike normal cells that reverse back to aerobic metabolism cancer cells **remain permanently locked** into the anaerobic method of energy production.
- He has theorized that an alternating current oscillating circuit exists inside of cells between the cell membrane and the DNA that is conducted over electronic protein polymers inside of the cell. This circuit is activated during differentiation to trigger the expression of genes (Garnett et al., 2002). *If Garnett is correct then it means that cells use their electrical properties to control gene expression.* **(Seems like a tie-in here with the early, "energy forcing function", high intensity EMF's of Earth millions/billions of years ago, in regard to gene expression and rapid evolution!….J. Beal)**
- Garnett has conjectured that the part of the DNA coiled around protein structures called **nucleosomes** may exhibit **electronic inductance**. "As a coil, it has **electronic inductance**, and since we have a series of coils, we have **a series inductance**

circuit. DNA current passes initially through the helix in a state where it can discharge its field energy. Hence we have **a pulse within the DNA** interacting with other biomolecules like the membrane. The pulse can go in and come out, and the DNA is not imperiled (Garnett, 2000)."

- He has subsequently developed after thousands of attempts a water-soluble and fat-soluble liquid crystal polymer compound composed of palladium and lipoic acid (Poly MVA) that is able to enter the cell and reestablish the electrical connection between the cell membrane and DNA. Garnett's research shows that liquid crystal polymers like prothrombin, hyaluronic acid and palladium-lipoic acid complex (Poly MVA) normally produces **fern structures**. *In my opinion these types of structure are molecular antennas and electrical conductors.*
- This **new nontoxic drug** acts as an electrical shunt that causes cells that utilize anaerobic glycolysis to undergo membrane rupture and die while leaving aerobic cells that utilize efficient oxygen-dependent electron transfer undamaged (Garnett, 1998; Garnett and Remo, 2001). Aerobic cells are protected from this electrocution because their functional mitochondria **normally engage in electron transport** ending with oxygen as the final electron acceptor (Garnett and Remo, 2001).

Electrical properties of the ECM

- The proteoglycans that compose the ground substance of the ECM are negatively charged. The number and type of sialic acid residues that cap the glycoproteins of the cell coat also determine the degree of negative charge of the cell surface. The negative charges of the ECM-glycocalyx interface helps determine water balance, ion balance and osmotic balance both in the ground substance of the ECM and inside of the cells.
- The ECM proteoglycans exist in **fern shapes** that allow electric charges to flow and **disorganized shapes** that impair transit through the ECM of electrical currents and nutrients. These disorganized shapes occur when tissue inflammation is present and toxins are present in the ECM. These factors create areas of high electrical resistance. Tissues of the body that are injured have a higher electrical resistance than the surrounding tissue. The cell membranes of these tissues become less permeable to the flow of ions and more electrically insulated. This results in the endogenous bioelectric currents avoiding these areas of high resistance (Wing, 1989). The reduction in electrical flow through an injured area is one factor that interferes with healing.
- Increasing the electrical resistance of a tissue will impede the flow of healing biocurrents (Becker, 1985). Decreasing the electrical flow through an injured area also results in a decrease of the membrane capacitance of the cells in that area.
- Conversely improving the electrical conductance of the ECM will improve healing and improve cell membrane charge. Correction of tissue inflammation and ECM toxicity can improve the electrical functions of the ECM. Therefore the composition and degree of toxicity of the ECM-glycocalyx interface will affect the electrical field and the flow of biocurrents in the ECM. The electrical field and biocurrent conduction in the ECM in turn will affect: cell membrane capacitance, permeability of the cell membrane, signaling mechanisms of the cell membrane, intracellular mineral concentrations, nutrient flow into the cell and waste disposal (Wing, 1989; Oschman, 2000).
- **The ECM can be cleared of toxins** by a variety of measures. Detoxification strategies could include the use of antioxidants and the support of antioxidant pathways, oral enzymes, homeopathic and herbal preparations, chelation (IV and oral), infrasonic devices, multiwave oscillators, microcurrent devices and phototherapy devices (lasers and LEDS). Some clinicians use live blood microscopy to see if their therapies are increasing the entry of wastes into the bloodstream. If a live blood slide

shows a marked increase in wastes after a treatment compared to a slide obtained before treatment then the clinician can tell that his or her treatment is cleaning the walls of blood vessels and removing toxins from the extracellular space.

- The body's biocurrents and the electrical field of the ECM controls cell differentiation and the metabolic activity of mature cells. Mesenchymal cells will differentiate under the influence of electrical fields: fibroblasts to fibrocytes, myoblasts to myocytes, chondroblasts to chondrocytes and osteoblasts to osteocytes (Becker, 1985).
- The bioelectric control system's contribution to cell differentiation and cell growth can be assisted by: use of certain types of waters ***("certain types of waters" pushes my wonder button. Can there be some brief detail here??….J. Beal)*** that enhance the liquid crystal properties of ECM polymers, promoting cell production of ECM proteins and proteoglycans; providing exogenous growth factor control and mediators of inflammation, promoting internal production of growth factors and inflammatory mediator by ECM cells and other factors.

Pathology of the ECM

- The ECM can be a storage site for nutrients or it can be a dumping ground for toxins, which can disrupt the metabolic and electrical functions of the ECM.
- Deposition of pathological deposits of proteins and toxins can lead to degenerative processes (e.g. amyloid can lead to Alzheimer's, immune complex deposition can lead to autoimmune inflammation).
- Inflammatory processes can lead to the deposition of crystals, calcium, cholesterol, and edema.
- The ECM is a buffering system for acids excreted by the cells. Impairment in the ability to excrete these acids or over production of acids by metabolic dysregulation will first lead to acidification of the ECM. Chronic acidification of the ECM will eventually lead to increased acidification of the intracellular compartment, which can create impairment of cellular metabolic processes especially aerobic energy production. Eventually disruption of cellular organelle functions and structures will occur.
- Excessive acidification of the ECM will eventually lead to saturation of the buffering capacity of ECM proteins. This will result in mobilization of calcium, magnesium and heavy metals from the skeleton.
- When calcium, magnesium, and other minerals are chronically mobilized from the bone for use as mineral buffers, these minerals will be lost through the kidneys and will create total body depletion of these minerals. Excessive and prolonged acidic conditions will result in increased mineral mobilization from the skeleton. Such a condition will first create osteopenia and in the long run will eventually progress to osteoporosis and compression fractures.
- Increased mobilization of heavy metals will lead to metabolic stress on the kidneys as these organs attempt to excrete these metals by use of glutathione detoxification. If the glutathione system becomes depleted due to excessive toxic burden these heavy metals will accumulate in the kidneys. Heavy metal accumulation in the kidneys may account for $1/6^{th}$ of the cases of hypertension in middle-aged people. This mechanism is one reason that the incidence of hypertension rises in post-menopausal women. *In my experience supporting kidney glutathione detoxification can reduce hypertension in some individuals.***This section contains information about:**

1. **The different intracellular mineral concentrations in tumors**

2. **pH alterations in tumors**
3. **How to alter intracellular pH in cancers**
4. **Tumor hypoxic regions**
5. **Tumor cell coats the role of hCG and sialic acid**
6. **The low transmembrane potential of cancer cells**
7. **How to increase low transmembrane potential in cancer cells**
8. **How to increase intracellular mineral concentrations of potassium, magnesium and calcium when low mineral conditions exist in malignant tissues**
9. **The role of Nieper minerals transporters**
10. **And why the number 42 is the universal answer to all questions**

Mineral and water abnormalities in cancerous and injured tissues: sodium, potassium, magnesium and calcium: their effect on cell membrane potential.

- The cell membrane is a dividing structure that maintains biochemically distinct compartments between the inside (intracellular) and outside (extracellular) spaces (Marieb 1998).
- The lipid structure of a cell membrane makes it relatively impermeable to the passage of charged molecules. Therefore charged molecules must cross through ion channels. Ion channels are transmembrane protein molecules that contain aqueous pores connecting the inside of the cell to the extracellular space. These channels can open and shut in response to a variety of signals. The passage of charged molecules through ion channels in the cell membrane endows the membrane with an electrical conductive property allowing for inward and outward current flows (Aidley and Stanfield, 1996). This is one factor that establishes electric circuits in biological tissues.
- In order to maintain balance in intracellular fluid and electrolytes, water, sodium and potassium are in constant motion between the intracellular and extracellular compartments (Edwards 1998).
- Extracellular fluids and intracellular fluids contain different concentrations of minerals. These minerals carry positive charges and are called cations. In order to maintain electric neutrality negatively charged molecules called anions must match these cations in concentration. Sodium is the main cation of ECF whereas potassium is the major cation of ICF. Chloride and bicarbonate are the main anions of ECF, while proteins and organic phosphates are the main anions of ICF.
- Uncharged molecules such as glucose or urea are also present in both compartments (Edwards, 1998).
- The passage of electrically charged ions through a membrane will create a flow of electric currents through the membrane. These ions in turn will affect the metabolism of the cell and the potential of the cell membrane.
- So it would be expected that all living cells of the body would naturally have a weak, electric current flowing through them. In fact there are bioelectrical circuits continually circulating throughout the body (Stanish, 1985).
- Overall mineral, water and membrane changes in cancerous tissues play important roles in changing the cellular geometry, metabolic biochemistry and electrical properties of cancer cells.

- Keith Brewer has reported that intracellular calcium and magnesium concentrations are lower in cancer cells due to impaired membrane transport (Brewer, 1985). According to Brewer **the transport of substances across the cell membrane is controlled by**: the electrical properties of the chemical bonds on and in the membrane, the electrical gradient across the membrane, and the electrical attractions between positively charged cations and polar molecules with positive and negative regions (Brewer and Passwater, 1976).
- F.W. Cope in his writings has described a characteristic pattern of electrolyte and fluid abnormalities that occur in any tissue that is damaged. He calls this pattern the 'tissue damage syndrome'. When cells are injured from any cause cells will lose potassium, and accumulate sodium and water (Cope, 1978).
- According to Cope, the proteins of a healthy cell exist in normal electronic configurational state where a **significant proportion of cell water is structured or bound in concentric rings around the protein molecules**. In addition *when the proteins are in their healthy configuration* the negatively charged sites on the protein matrix will have **a greater preference for association with potassium** rather than with sodium (Cope, 1978). If Cope is correct this may be one of the factors that accounts for the finding that healthy cells have high cell potassium and low cell sodium concentrations.
- A number of proteins are present within the cell and in the ECM. Other proteins lie on the inner and outer surface of cell membranes and some are embedded within the cell membrane. These proteins consist of linear chains of amino acid residues with attached carbohydrate and or lipid molecules. The electro attractive and repulsive forces between these components and the external or internal salt-water environment cause these proteins to fold into three-dimensional shapes called **conformational states**. Protein function is dependent on these conformational states. The cell membrane and its associated membrane proteins are dynamically active with the associated proteins undergoing continuous changes in state. In proteins that are enzymes the conformational state determines whether or not the enzyme will expose its ligand binding sites.
- But if the membrane protein is an ion channel the conformational structure will determine whether the channel is open or closed. When the channel is open it is able to pass ions such as potassium, sodium, chloride, and calcium, across the cell membrane (Hille, 1992). The cell membrane is impermeable to ions unless its protein based ion channels are open. Normally the cell membrane establishes different concentrations of charged ions on either side of the membrane. This cell membrane property creates an electrical potential across the membrane.
- The ability of the cell proteins to stay in their normal configurational state is dependent on the cell being free from chemical, physical or hypoxic damage. When physical, chemical or hypoxic damage occurs to a cell many cell proteins will change to an abnormal damaged configurational state. In that state "the cell proteins lose their preference for association with potassium rather than sodium, and lose much of their ability to structure water" (Cope, 1978). When these protein changes occur potassium leaves the cell and is replaced by sodium. In addition the water content and the percentage of unbound water within the cell increases (the cell swells) (Ling and Ochsenfeld, 1976).
- Proteins can also be induced to resume their normal configuration **by measures that increase the intracellular concentration of potassium, magnesium, and ATP**. This will result in cell water becoming more structured and will cause the cell to release unstructured cell water and sodium (Cope, 1978). *Note: magnesium is involved in maintaining the intracellular concentration of potassium.*

- The structuring of water around intracellular proteins will also affect the configurational state, liquid crystal, and electrical properties of these proteins. Structured or bound water has less freedom of movement than unbound water. Nuclear magnetic resonance (NMR) can be used to measure the amount of water that is structured in normal and cancerous cells. Hazelwood and his colleagues showed in a 1974 NMR study that malignant tissues have significantly increased amounts of unbound water compared to normal tissues (Hazelwood, 1984).
- The changes in **the degree that water is structured in a cell or in the ECM** will affect the configurations and liquid crystal properties of proteins, cell membranes, organelle membranes and DNA. *Healthy tissues have more structured water than unhealthy tissues. Clinicians who recognize this fact have found that certain types of music, toning, chanting, tuning forks, singing bowls, magnetic waters, certain types of frequency generators, phototherapy treatments and homeopathic preparations can improve water structuring in the tissues and health when they are correctly utilized.*
- In cancer a number of features such as changes in the mineral concentrations inside of the cell, the degree that water is structured inside of the cell and an excess of negative electrical charges on the exterior surface of the cell cause the cell membrane potential of cancerous cells to be less than normal (Cone, 1970).
- Cancerous tissues and less differentiated regenerating tissues are more electronegative than normal cells and normal tissues (Ambrose et al., 1969; Schaubel et al., 1970; Becker, 1985).
- Cone reported in 1975 that the electrical potential of cancer cell membranes was significantly less than the membrane electrical potential of healthy cells. Basically the lower membrane potential of cancer cells is associated with higher intracellular sodium concentrations and lower intracellular potassium concentrations (Cone, 1975).
- Cone found that healthy cells have higher intracellular potassium, lower intracellular sodium and higher electrical cell membrane potential, while cancer cells have higher sodium, lower potassium, and lower membrane electrical potential. As a result of increased intracellular sodium cancer cells will retain more water causing them to be more spherical and have different geometry than normal cells. When cells become swollen with too much water: normal cell signaling mechanisms are disrupted; aerobic cellular metabolism of sugars is inhibited; and ATP production falls.
- **Intracellular sodium has a mitotic regulating effect.** Clarence D. Cone, Jr. has postulated that an unfavorable intracellular sodium-potassium ratio with excessive intracellular sodium and low intracellular potassium could affect the transmembrane potential of malignant cells (Cone, 1975) and predispose to malignant mitogenesis (Regelson, 1980).

Tumor cell differentiation, tumor hypoxia and low cellular pH can affect: gene expression, genetic stability, genetic repair, protein structures, protein activity, intracellular mineral concentrations, and types of metabolic pathways used for energy production

- Cancers often exhibit increasingly malignant behavior during their growth. WHY?
- One reason is that cancerous tumors are composed of cell populations that range from highly aggressive undifferentiated cells to well differentiated cells. Some cancers are almost completely composed of undifferentiated cells that are biochemically similar to embryonic cells because of increased expression of embryonic genes. Highly undifferentiated tumors typically produce gene products such as proteins like alpha-fetoprotein (AFP) and carcinoembryonic antigen (CEA), enzymes and

hormones such as human chorionic gonadotropin (hCG) that are characteristic of embryonic tissues. On the other hand tumors with well-differentiated cells will produce gene products more closely resembling normal adult tissues. In general tumors with highly undifferentiated cells are more invasive than tumors composed of well-differentiated cells or tumors with mixed cell populations.

- Increased malignant behavior during tumor growth is also affected by the microenvironment of tumors, which is characterized by fluctuating areas of both acute and chronic hypoxia, low pH, and nutrient deprivation (Moulder et al., 1987; Rockwell, 1992).
- The severity of hypoxia and acidosis in tumors can affect tumor cell invasiveness, metastasis, the risk of recurrence and resistance to chemotherapy and radiation therapy (Teicher, 1994; Rofstad, 2000).
- Tumors exist in a dynamic Darwinian state of survival of the fittest. Tumors continually secrete growth factors that initiate the formation of new blood vessels, yet many tumors grow so rapidly that they out grow their blood supply so that large tumors will have areas that are poorly oxygenated (hypoxic) and other areas that are well oxygenated (Vaupel et al., 1991). Hypoxic and well-oxygenated areas will actually fluctuate coming and going as blood vessels form and then regress (Holash et al., 1999).
- Tumors with areas of mixed oxygenation will often contain heterogeneous groups of cells that exhibit biochemical diversity. The same tumor will have some cells that are utilizing different metabolic reactions to create energy than other groups of cells in the same tumor. This is one reason why different cell populations in the same tumor will respond differently to treatment measures. Some cells will be killed by some treatments while other cells will survive and in a sense be selected for further growth (Gray et al., 1953; Graeber et al., 1996).
- Fluctuating oxygen levels will result in fluctuations in the types of genes that are activated, types of proteins that are produced and the types of metabolic reactions that occur (Dang et al., 1997). Fluctuations in the types of metabolic reactions used to create energy will result in variations in lactic acid production, acid excretion and acid accumulation both within the cells and in within the ECM.
- In vitro studies have shown that tumor cell surface adhesion molecules are down regulated upon exposure to hypoxia conditions (Hasan et al., 1998). This means that hypoxia can result in decreased cell adhesion of tumor cells to the ECM. Loss of contact with the ECM permits tumor cells to spread to more distant locations and reduces the ability of the ECM to exert growth inhibition.
- Some researchers have focused on the finding that the hypoxic and acidic microenvironment of tumors will create further genetic instability and mutations (Reynolds et al., 1996). Hypoxia and acidic tumor microenvironments will cause certain genes to become activated and expressed and other genes to be inactivated so that the metabolic reactions of tumor cells will be altered. These conditions can also create DNA damage and impair DNA repair mechanisms (Yuan et al., 1998, 2000).
- Low intracellular pH can alter the conformational structure and function of cellular proteins, including DNA polymerases (Eckert and Kunkel, 1993).
- One common characteristic of many tumors is the reduced activity of a special protein called p53 that is involved in triggering cell death. Hypoxic conditions will favor selection of tumor cells with reduced apoptotic potential (Graeber et al., 1999).

- Tumor cells that are hypoxic lack enough oxygen to activate their aerobic metabolic pathways. These cells will typically begin to rely on anaerobic metabolism to supply their energy needs (Rossi-Fanelli et al., 1991). Tumor cells in hypoxic conditions will convert most of their pyruvate to lactate instead of to acetyl Coenzyme A (Warburg, 1956). This type of energy production is very inefficient so tumors require much larger amounts of sugar in order to maintain their energy production. Tumor cells in a sense become sugar junkies.

Tumor cells express several adaptations in order to sustain their sugar addiction and metabolic strategies to address this issue.

- Tumor cells will express larger amounts of glucose receptors/transporters on their cell surface in order to increase their sugar uptake (Van Winkle, 1999). In fact hypoxia stimulates the transcription of numerous genes including genes that code for enzymes of the glycolytic pathway and cell membrane glucose transport proteins GLUT-1 and GLUT-3 (Semenza, 2002). The administration of cesium salts has been reported to limit tumor cell uptake of glucose, which starves the cancer cell and reduces its ability to make energy by fermentation.
- Tumor cells will increase the activity of an intracellular enzyme called glucokinase. An extract of avocado called mannoheptulose has been found to inhibit glucose entry into tumor cells and reduce the activity of glucokinase an enzyme that sequesters sugar inside of the cell (Board et al., 1995).
- Some tumor cells express glycoproteins that promote protein breakdown (Stipanuk, 2000). The secretion of cytokines, especially tumor necrosis factor, increases in cancer. Some of these cytokines increase the breakdown of tissue proteins (Bender, 2002). The amino acids released by protein breakdown can be used in gluconeogenesis. Tumor necrosis factor not only promotes protein breakdown, but it also increases gluconeogenesis (Bender, 2002).
- Many tumor cells will produce lactate when they metabolize glucose anaerobically. The lactate is exported from the tumor cells and is utilized by the liver in gluconeogenesis (Bender, 2002).
- **Overall gluconeogenesis is stimulated when cancer is present**. Gluconeogenesis requires a great deal of energy and excessive gluconeogenesis is thought to be a significant factor that contributes to cancer cachexia (Gold, 1968).
- Dr. Joseph Gold recognized in the 1960's that metabolic strategies that inhibited the enzyme phosphoenol pyruvate carboxykinase (PEP-CK) would reduce gluconeogenesis and decrease the severity of cachexia (Gold, 1968). Dr. Gold after testing a series of compounds found that hydrazine sulfate could effectively reduce excessive gluconeogenesis in cancer (Gold, 1974, 1981).

Tumor acidification versus tumor alkalization

- **One of the characteristic features of cancers is that cancerous cells rapidly divide and proliferate.** In general growing cancers have many cells that are undergoing mitosis. According to Keith Brewer, normal and malignant cells undergo mitosis between a pH range of 6.5 – 7.5 and the mitosis rate slows as the intracellular pH approaches the extremes of this range. If a cell can be forced into a pH outside of this range cell division ceases (Brewer, 1985).
- Recognition of this fact serves as the basis for therapies that increase or decrease the pH of tumor cells.

- When it was first discovered that tumors utilize anaerobic metabolism of glucose it was thought that providing more oxygen would convert tumors back to aerobic metabolism (Warburg, 1930), unfortunately tumors still exhibit high levels of glycolysis even under aerobic conditions (Weinhouse, 1976).
- Because glycolytic metabolism predominates in tumors some lactic acid accumulation and intracellular acidification may occur **in tumors under hypoxic conditions** although most of the lactic acid and hydrogen ions are exported into the ECM leading to acidification of the ECM (Ojugo et al., 1999). The extracellular pH around tumor tissues is usually more acidic than the extracellular pH of normal tissues. Extracellular pH levels as low as 7.09 have been measured in some human tumors (Van der Zee et al., 1989). It is thought that both lactate and hydrogen protons are exported from tumor cells into the extracellular space as a way of limiting intracellular acidity (Ojugo et al., 1999).
- Tumor cells are so efficient in sequestering and exporting acids that they are often able to maintain their cytoplasmic pH nearly equal to that of normal cells, which is about 7.0- 7.3 (Newell et al., 1993; Stubbs at al., 1994).
- Intracellular cytoplasmic pH is maintained in tumor cells by sequestration of acids in cytoplasmic vesicles and cell membrane mechanisms that include: a sodium hydrogen ion exchanger, lactate transport out of tumor cells, and chloride and bicarbonate exchange (Webb et al., 1999). Sodium movement into the cells enables the membrane exchange system to pump hydrogen ions out of the cell (Mahnensmith and Aronson, 1985). The net result of activating the sodium-hydrogen ion exchanger is that *sodium accumulates inside of tumor cells*.
- Intracellular concentrations of sodium are typically higher in malignant cells than in normal cells (Cone, 1975; Cope, 1978; Seeger and Wolz, 1990; Cure, 1991, 1995).
- Although tumor cells are relatively efficient in exporting acid (hydrogen protons) into the ECM and sequestering acids in cytoplasmic vesicles. I believe the buildup of intracellular acids in cytoplasmic vesicles may still possibly interfere with mitochondrial production of ATP by disrupting the hydrogen ion gradient across the mitochondrial membrane. This would create a positive feedback loop where anaerobic glycolysis creates an intracellular acidic condition that further interferes with oxygen-mediated electron transport in the mitochondria. Therefore in order to maintain energy anaerobic glycolysis would be continued.
- **Tumor acidification:** When agents are used to block the movement of lactate and hydrogen protons from tumor cells the effects of therapies that increase cellular acidification are enhanced. Blockage of the export of lactic acid will result in a significant reduction in intracellular pH.
- **Augmentation of tumor acidification by increasing lactic acid production and blocking tumor cell lactate excretion:** The bioflavinoid quercitin has been found to inhibit the synthesis of heat shock proteins in tumors and to block the export of lactate from tumors creating lethal levels of intracellular acidity (Kim et al, 1984). The use of quercitin as a cancer treatment has been the subject of several patents. Unfortunately, this treatment is generally effective only in the hypoxic portion of tumors and is generally ineffective in tumors and areas of tumors that are not hypoxic. Use of quercitin is most effective when hyperthermic treatments are used concurrently.
- The creation of a hyperglycemic condition can contribute to further intracellular acidification. A number of researchers have reported on the use of oral and IV glucose as a way to increase tumor acidity (Volk et al., 1993; Leeper et al., 1998).

- Research studies have shown that extracellular acidification of tumors will enhance the effect of hyperthermia (Gerweck, 1977; Wike-Hooley, 1984; van de Merwe et al, 1993) and inhibit the development of thermotolerance in cultured tumor cells (Goldin and Leeper, 1981).
- Manfred von Ardenne of Germany was one of the pioneers who back in the 1960's began developing a treatment of cancer utilizing IV glucose to create increased levels of tumor acidity. He would then use hyperthermia to kill cancer cells that were already compromised by excessive acidity (von Ardenne, 1994).
- Cancer researchers are studying the use of both intracellular and extracellular acidification of tumors to enhance the cytotoxic effects chemotherapeutic agents (Atema et al., 1993; Skarsgard et al., 1995; Kuin et al., 1999).
- **Tumor alkalization**: Cesium is a naturally occurring alkaline element that was promoted for use in cancer by a scientist named Keith Brewer, since cesium is preferentially taken up by tumor cells (Brewer, 1985). Use of Cesium is thought to reduce the cellular uptake of glucose by cancer cells leading to starvation of the cell. Cesium also was reported by Brewer to raise the cell pH of cancer cells up to a range of 8.0. Brewer thought that raising the pH of cancer cells this high would kill cancer cells. Use of cesium in cancer has met with mixed results (Sartori, 1984). ***I caution anyone who might be tempted to use this treatment to read extensively about cesium before administering this compound.***

The pH of the intracellular and extracellular compartments will also affect the intracellular potassium concentration.

- **Acidic and alkaline conditions:** Cellular uptake of potassium is postulated to be regulated by a membrane associated energy and magnesium dependent sodium/potassium pump. Although Dr. Gilbert Ling has a completely different opinion of the mechanisms that cells use to regulate intracellular potassium concentrations (Ling, 2001). **He basically believes that the membrane pump theory is wrong.** He has extensively published information on his association-induction (AI) hypothesis, which includes the idea that ATP bonding to intracellular proteins mediates selective and preferential absorption of potassium over sodium (Ling, 2001). I personally find Dr. Ling's work to be highly technical, but very informative.
- Movement of potassium out of the cell interior is regulated by **acidity of the cell interior**, the **permeability of the cell membrane** and **chemical and electrical gradients** to the potassium ions.
- Accumulation of positively charged hydrogen cations inside of the cells through either respiratory or metabolic acidosis will promotes a shift of potassium out of the cells, leading to higher than normal levels of potassium in the bloodstream (hyperkalaemia), lower than normal potassium intracellularly and increased potassium loss through the kidneys.
- When intracellular acidity develops from alterations in intracellular metabolism, such as occurs in anaerobic metabolism, excessive amounts of hydrogen ions are created inside of the cell.
- Cancer cells attempt to reduce cytoplasmic hydrogen cation concentrations by exporting the hydrogen cations into the EC space and by compartmentalizing the hydrogen cations in cytoplasmic storage vesicles (Webb et al., 1999).
- The accumulation of excess in positive charge will cause cancer cells to export both hydrogen ions and potassium in order to maintain electrical neutrality. This appears to me to be one more way that cancer cells lose potassium.
- When cancer cells export hydrogen ions the ECF space becomes more acidic (lower pH). The amount of acids produced by cancer cells may even be severe enough to overwhelm the body's homeostatic pH regulatory mechanisms.

- Cancer cells as a group are very efficient in exporting and compartmentalizing hydrogen cations. Some cancer cells are so efficient that they actually become more alkaline than normal cells, but other cancer cells that are not able to completely reduce the concentration of positively charged hydrogen ions in their cytoplasm will have a pH that is typically lower than nonmalignant cells. The studies I found on cancer cell pH showed that there was diversity in intracellular pH levels. In general cancer cells in hypoxic areas will have to deal with larger amounts of acid.
- The cell cytoplasm of malignant cells may or may not be acidic depending on how efficient tumor cells are in sequestering and exporting acids. But the ECM around tumor cells is acidic. By definition acidic tissues are electron deficient. So a tumor may have areas that have a relative state of electron deficiency. *This condition of electron deficiency may help explain why measures that increase electron availably like magnetized waters, lemon juice, negative ion generators, standing by water falls, standing by the ocean surf, use of electron rich antioxidants, consumption of electron dense foods (fresh vegetables and vegetable juices and essential fatty acids like fresh flax oil) help some people with chronic degenerative conditions and cancers get better. Note: many chronic degenerative conditions are associated with tissue acidity.*
- Awareness of such findings gives credence to nutritional approaches to cancer such as the dietary program advocated by Max B. Gerson. Dr. Gerson during his medical career advocated low sodium intake and high potassium supplementation through use of raw vegetable juices and potassium supplementation (Cope, 1978; Ling, 1983).

Tumor cell coats contain human chorionic gonadotropin and sialic acid as well as negatively charged residues of RNA, which give tumor cells a strong negative charge on their cell surface

- All cells have cell surface glycoproteins. As cells specialize they develop unique sets of cell surface glycoproteins that allow cells of the same type to recognize, communicate and adhere to each other (Reichart, 1999).
- These cell surface glycoproteins contain varying concentrations of sialic acid, which is one of the primary molecules responsible for conferring a negative charge to the cell surface of all cells (Cure, 1995; Acevedo et al., 1998). The chemical characteristics of hCG make it a sialoglycoprotein (Acevedo, 2002)
- Human chorionic gonadotropin (hCG) is a hormone usually associated with pregnancy, however hCG or subunits of **hCG can be found on the surface of all cancer cells** (Acevedo et al., 1998; Acevedo, 2002). Dr. Acevedo has proposed that the presence of hCG on the surface of cancer cells **is a universal marker for cancer** (Acevedo et al., 1995; Acevedo, 2002).
- According to Dr. Acevedo malignant transformation will cause the genes that code for hCG to become activated causing cancer cells to begin producing this hormone (Acevedo, 2002). When cancer cells secrete this hormone it collects on the cell surface. Since hCG contains large amounts of sialic acid this results in cancer cells having a **stronger cell surface negative charge** than normal cells (Acevedo et al., 1998).
- Cure in his papers presents data that cancer cells are also coated by negatively charged residues of RNA, which is another contributing factor to the strong cell surface negative charge of cancer cells (Cure, 1991, 1995). Cure also presents data that suggests that bacteria can secrete compounds that can increase the negative charge of cells to which they are attached or bacteria and viruses can cause cells that they infect to secrete compounds that increase the negative charge of the cells.

- Because immune defense cells such as NK cells and macrophages also have a negative charge these cells are repulsed by the strong negative electrical field of cancer cells when they try to approach these cells (Van Rinsum et al., 1986; Cure, 1995; Acevedo et al., 1998). According to Dr. Acevedo, "Since all the normal cells from our immune system, macrophages, NK cells and B cells, express in their membranes a "normal" negative charge, the high negative charge of hCG and its subunits demonstrated to be present in the cell membranes of embryonic and fetal cells, in sperm cells in every stage of development, and in all cancer cells irrespective of type or origin as membrane-associated hCG, make all these cells **immunologically inert**. The cells from the immune system *are restricted from approaching, and adhering to cancer cells*, since negative charges repel. That is the reason why the embryo and fetus, which under normal conditions are 50% foreign to the mother, are able to survive the immune system of the mother, and why sperm cells and cancer cells also survive (Acevedo, 2002)."

Biologically Closed Electric Circuits

- **The application of electrical currents into cancerous tissue has been found to have a beneficial effect in some cases of cancer.** Dr. Björn Nordenström and Dr. Rudolf Pekar have pioneered research where specially made platinum needles (electrodes) are inserted directly into tumors (Nordenström, 1983; Pekar, 1997). This form of therapy is known as electrochemical therapy because it destroys portions of cancerous tumors by both electrical and chemical means. The needles are connected to an electrical device that produces a direct current. The needles with a **positive charge are anodes**, while the needles with a **negative charge are cathodes**.
- When low voltage (6 to 8 volts) and low micro-amperage (40-80mA) direct currents are administered the tumor area around the anode becomes highly acidic due to the attraction of negatively charged chloride ions and the formation of hydrochloric acid (pH 1-2). The tumor areas around the cathode become highly basic (pH 12-14) due to the attraction of positively charged sodium ions and the formation of sodium hydroxide (Yu-Ling, 1997). Chlorine gas emerges from the skin at entry points of the anodes and hydrogen gas emerges from the entry points of the cathodes (Chou et al., 1997). This strong change in pH is one of the factors involved in killing and injuring tumor cells. *So in a sense direct current stimulation is a form of pH therapy. I suspect that devices that create electromagnetic fields and current flows in the body all have some effect on intracellular and extracellular pH.*
- The effectiveness of this type of treatment is dependent on electrode placement and dosage of electrical charge administered in coulombs (Chou et al., 1997).
- Dr. Yu-Ling reported at Fourth International Symposium on Biologically Closed Electric Circuits that by 1997 over seven thousand cases of malignant tumors had been treated in China by this treatment (Yu-Ling, 1997).
- **One of Nordenström's techniques is to place the positive electrode into the tumor and the negative electrode outside of the tumor (O'Clock, 1997).** This will result in an increased flow of electrons into the tumor, a change in the electrical field around a tumor and activation of membrane receptors and ion channels. If tumor cells are in fact electron deficient this increased flow of electrons, membrane receptor effects and movement of ions through ion channels will have definite effects on cellular metabolic processes. O'Clock's work has also confirmed Ross Adey's findings that windows of frequency and amplitude exist for tumor cell suppression and proliferation (O'Clock, 1997).

- The application of direct current to tumor cells has been found to change the membrane potential of tumor cells, nutrient uptake by tumor cells, reduce DNA production by tumor cells and increase immune activity particularly **the attraction of white blood cells to the tumor site** (Chou et al., 1997; Douwes and Szasz, 1997; O'Clock, 1997).
- The application of direct current causes electrolysis, electrophoresis, electroosmosis and electroporation to occur in biological tissues creating microenvironmental chemical changes and microelectrical field changes (Li et al., 1997).
- Changing the membrane potential and membrane permeability of tumor cell membranes with direct current changes both the extracellular and intracellular environment of the tumor cells (Douwes and Szasz, 1997).
- The chemistry of the microenvironment of healthy cells, injured cells and cancerous cells and the microelectrical field of these cells are interrelated. *Changes in one results in changes in the other.* This is easier to remember if you understand that all the chemistry of biological organisms involves an exchange of energy.
- In my opinion this type of electrical treatment tumors will destroy some cells by electrolysis and cause other cancer cells to lose their stealth cloaking coating of negatively charged glycoprotein complexes that have hidden the tumor from the immune system. Loss of this cloaking device allows activation of immune defenses to attack the tumor, including production of cytokines and interferon and tumor destruction by cytotoxic T-cells and macrophages.

Bacteria and viruses in cancer

- Another interesting idea is the concept that bacteria and viruses can change the cell coats of cells and these infections are associated with certain types of cancer. Back in the 1950's Virginia Livingston-Wheeler promoted the idea that cancers are associated with a particular type of pleomorphic bacteria, she named **"Progenitor cryptocides"** (Greek for the hidden killer), after she consistently grew this microbe from cancerous tissues. For detailed information on her work see (Livingston-Wheeler and Wheeler, 1977; Livingston-Wheeler and Addeo, 1984; Cantwell, 1990).
- Certain types of bacteria are known to colonize areas of the body particularly areas that have compromised blood supply and regional hypoxia. These bacteria naturally produce biofilms as a way of protecting themselves from the immune system. For example, pseudomonas bacteria can produce a secretion of carbohydrates that they encapsulate themselves within (Straus et al., 1989). These negatively charged cell coats **electrically repulse attacking immune cells**. By attaching themselves to human tissue it is very likely that these bacteria are using electrical defenses and practicing a natural form of gene therapy.
- In fact some researchers are experimenting with the use of anaerobic bacteria as a form of cancer gene therapy. When anaerobic bacteria are injected into the body they will accumulate in hypoxic tumor areas. If suitably modified these bacteria could be engineered to produce antimalignant proteins as they reproduce (Lemmon et al., 1997).
- It takes no great stretch of the imagination to conceptualize the ideas that infectious agents could: 1) alter the genetic machinery of the cells to which they are attached promoting the production of certain proteins and hormones; 2) create biofilms around cells altering their surface charge and impacting cell mineral concentrations, cell membrane functions etc; 3) or secrete their own form of chorionic gonadotropin which would change the electrical characteristics of the cells to which they are attached.

- Human chorionic gonadotropin is also a growth factor for certain types of cancer. After reviewing the papers of Acevedo and Cure I have formed the opinion that that the presence of hCG on tumor cell surfaces will increase the negative electrical charge of cancer cells
- It is well recognized that cancer cells can produce this hormone, but certain types of tumor-associated bacteria also produce this hormone (Backus and Affronti, 1981). When Virginia Livingston Wheeler reported this same finding back in the early 1970's (Livingston-Wheeler and Livingston, 1974) her findings were dismissed and **she was labeled a quack**. ***(We need to license quacks, and keep accurate records, so we can find out which new ideas work and which ones do not!….J. Beal)*** Acevedo and others have repeatedly shown that some tumor-associated bacteria will produce hCG or components of this hormone.
- For example, Acevedo and his colleagues in 1987 did immunocytochemical studies using antisera to hCG, and to its alpha- and beta-subunits. They demonstrated the expression of hCG-like material in nine bacterial strains. "Seven of these were isolated from patients with cancer and were definitely identified as Streptococcus faecalis (three strains), Staphylococcus haemolyticus (two strains) and Staphylococcus epidermidis and Escherichia coli (single strains). The other two strains were cell-wall-deficient (CWD) variants, one identified as Streptococcus bovis, isolated from the blood of a patient with a fever of unknown origin and a possible brain abscess (Acevedo et al., 1987)."
- Coatings of proteins, glycoproteins and glycolipids encapsulate many viruses. These viral coats may contain either sialic acid or the enzyme sialidase. If sialic acid predominates the virus will have a negative charge, but if sialidase predominates the virus will have a positive charge (Cure, 1995). Either way many viruses are endowed with electrical charges. If sialidase predominates the positively charged virus will be electrically attracted to the negatively charged cell surface.
- An interesting clinical note is that arginine supplementation can activate latent herpes viral infections. Arginine contains a strongly basic guanidine group. It is possible that arginine can enhance the infectivity of certain types of viruses by changing the electrical charge of the virus or cell membranes.
- Inhibition of the sialidase enzyme will stop the entrance of viruses into cells. This leads to my point that viral inhibition may occur through chemical measures or electronic neutralization. Chicken soup is a well-known remedy for viral infections of the respiratory tract. When chicken soup is prepared without salt it contains large amounts of free electrons, which can electrically neutralize viruses with positively charged coats preventing viral entry into the cells.
- Theoretically electronic microcurrent, infrared, and phototherapy devices, homeopathic preparations and herbal preparations that supply the body with a plethora of free electrons should also exhibit antiviral activity.
- Treatments that have been reported to disrupt tumor cell coats include pancreatic enzymes (Acevedo et al., 1998), plant enzymes such as bromelain (Nieper, 1996), beta-carotene (Nieper, 1985); heparin (Nieper at al., 1999), and vaccines against HCH (Acevedo et al., 1998; Triozzi and Stevens, 1999).

Treatment Section: **Interfaces/nodal points where changes in cellular electrical activity and physiology can be made.**

Cellular and ECM electric field effects may be enhanced:

- By application of external conducted or inductive electric fields

- By correcting mineral deficiencies and improper cell location of minerals
- By correcting cell membrane abnormalities secondary to dietary deficiencies of essential fatty acids and imbalances in fatty acid metabolism.

Treatment devices

Microcurrents in biologically closed electric circuits may be created by:

1. Tissue-penetrating magnetic fields from PEMF devices that create magnetic field induction of electric currents in conductive biological structures.
2. Direct current and alternating current microcurrent devices applied to the skin by electrodes or into tissues through needles.
3. Acupuncture needling.
4. Production of a wide band width of electromagnetic energy by multi-wave oscillators
5. Needle implants into tumors with application of DC current.
6. Phototherapy treatments with lasers and LEDS.

- **The use of electrical and phototherapy devices** such as lasers and LEDS will change the electric field of the ECM and create current flow both in the ECM and through the cell membrane depending on the frequency applied. These changing electrical fields will modify the electrical potential of cell membranes, intracellular mineral concentrations and cellular energy production by affecting the activity of ionic membrane pumps (Liu et al., 1990; Blank, 1992).
- **Modification of the electrical potential of cell membranes can be used to increase the abnormally low transmembrane potential of cancer cells and injured tissues.** Effects that are seen when membrane potential is increased include: enhanced cellular energy (ATP) production, increased oxygen uptake, changes in entry of calcium, movement of sodium out of the cell, movement of potassium into the cell, changes in enzyme and biochemical activity, and changes in cellular pH.
- It appears that modulation of the electric field of the ECM and changing current flows in biologically closed electric circuits can increase low transmembrane potential, increase the entry of potassium and calcium, increase sodium and water movement out of the cells, reduce intracellular acidity, improve oxygen entry into hypoxic cells, increase mitochondrial production of ATP through aerobic metabolism.
- At this time researchers both promote and warn against the use of electric and magnetic field devices in cancer. The history of the electromagnetic treatment of cancer is long and colorful. Because it would require an entire book to fully explore this history I will limit this discussion to a few points.
- Back in the early 1920's George Lakhovsky developed an instrument he called a Radio-cellular oscillator, which he used to experiment on geraniums that had been inoculated with cancer (Lakhovsky, 1939). From these experiments he decided that he could obtain better results if he constructed an apparatus capable of generating a range of frequencies from 3 meters to infrared (Lakhovsky, 1934). Lakhovsky believed that living organisms are capable of interrelating by receiving and giving off electromagnetic radiations. *Note: If Lakhovsky's theory is correct then the potential exists for direct energetic communication between living organisms.*

- Lakhovsky theorized that each cell of the body is characterized by its own unique oscillation. He also believed that one of the essential causes of cancer formation was that cancerous cells were in oscillatory disequilibrium. He believed the way to bring cells that were in disequilibrium back to their normal oscillations was to provide an oscillatory shock (Lakhovsky, 1939).
- Royal Rife on the other hand believed that oscillatory shock could be used to kill infectious organisms and cancer cells. Either way changing the oscillation of cancer cells has been thought to be beneficial.
- Lakhovsky theorized that an instrument that provided a multitude of frequencies would allow every cell to find and vibrate in resonance with its own frequency. In 1931 he invented an instrument called the Multiple Wave Oscillator. Until his death in 1942 he treated and cured a number of cancer patients (Lakhovsky, 1939). Other individuals who have used his MWO have also reported similar results.
- Individuals such as Royal Rife in the 1930's and Antoine Priore in the 1960's also invented electronic equipment that was reported to benefit patients with cancer (Bearden, 1988). Whether you believe these experiments or not is up to you. But if Lakhovsky, Rife and Priore were right, then equipment that addresses and attempts to correct the electrical derangements of cancer cells can be beneficial in some cases.

Polychromatic states and health: a unifying theory?

- Prigonine's 1967 description of dissipative structures gave a model and an understanding of how open systems like biological organisms that have an uninterrupted flow of energy can self-organize. Biological systems are designed to take in and utilize energy from chemical sources (food), but they can also utilize energy and information from resonant interactions with electromagnetic fields and acoustical waves to maintain their dynamic organization. According to Ho, "Energy flow is of no consequence unless the energy is trapped and stored within the system, where it circulates before being dissipated (Ho, 1996)."
- In my opinion this means that cellular structures that transduce, store, conduct and couple energy are critical features of any living organism.
- Living systems are characterized by a complex spectrum of coordinated action and rapid intercommunication between all parts (Ho, 1996). The ideal complex activity spectrum of a healthy state is polychromatic where **all frequencies** of stored energy in the spectral range are equally represented and utilized (Ho, 1996). In an unhealthy state some frequencies may be present in excess and other frequencies may be missing. For example it has been reported that a healthy forest emits a polychromatic spectrum of acoustical frequencies and an unhealthy forest will have holes in its frequency spectrum. Yet when the forest regains its health it again emits a polychromatic spectrum of frequencies. The frequency holes got filed in!
- When an area of the body is not properly communicating it will fall back on its own mode of frequency production, which according to Mae-Wan Ho leads to an **impoverishment of its frequency spectrum**. In looking at the example of cardiac frequency analyzers it has been discovered that sick individuals have less heart rate variability than healthy individuals.
- The concept of polychromatism makes sense when you consider phenomena such as the healing effects of: sunlight, full spectrum lights, music, tuning forks, chanting, toning, drumming, crystal bowls, sound therapy, prayer, love, the sound of a loved one's voice, essential oils, flower essences, healing touch, multiwave oscillators, and homeopathics. Something or things (frequency or frequencies) that were missing are provided by these treatments.

- From the consideration of applied frequency technologies it can be theorized that one aspect of why these consonant technologies work is because they supply frequencies that are missing in the electromagnetic and acoustical spectral emissions of living organisms. When missing frequencies are supplied they in a sense fill gaps in the frequency spectrum of a living organism. Dissonant technologies would identify frequency excesses and pathogenic frequencies and would provide frequency neutralization by phase reversal.
- Electromagnetic technologies such as Rife and radionics ***(I have a problem here with the term "radionics". The radionic devices I am familiar with <u>sometimes</u> contain electronic components which do not have to be functioning and these devices always require the human instrument for interpretation through touch or feeling. When, and if, these devices work it is most likely they primarily serve as psychological transfer and focusing agents Suggest Lakhovsky and/or Priore instead of "radionics"….J. Beal)*** may act by phase reversal and neutralization of pathogenic frequencies. Royal Rife also theorized that his equipment used resonant transmission of energy that caused pathogenic organisms to oscillate to the point of destruction.
- If we consider polychromatism to be the model of the healthy state then it makes sense that technologies such as electrodermal screening and voice analysis that detect frequency imbalances (excesses and deficiencies) can play beneficial roles in health care.
- I believe that in the future doctors will more widely utilize equipment such as electrodermal screening, acoustical spectrum analyzers, electromagnetic spectral emission analyzers and their software for diagnostic purposes. This type of equipment can be used to identify and treat frequency imbalances. ***(Not only in the body, but also, it is most important that we consider the EMF aspects of the environment lived in…..J. Beal)***
- This discussion ties in such concepts as acupuncture and neural therapy.
- **Acupuncture** may help address and remove impedances or blocks to energy mobilization by helping to reconnect disconnected energy pathways back into a coherent and harmonic flow.
- **Neural therapy** may act by neutralizing aberrant local signal generators in traumatized and scarred tissue. In a sense removing disharmonies from a particular location. I imagine the application of neural therapy to be like a band conductor correcting a student who is playing the music out of key.

Ways to support the electrical properties of cells with mineral nutrition and cell membrane repair

- In order for cells to operate and control electromagnetic energy and chemical energy production, the cell membranes, which covers the cells and the membranes of cell organelles like the mitochondria and the nucleus must be healthy and the **right minerals** must be in the **right location** and in the **right concentrations**. Dr. Hans Nieper recognized this fact and he spent his life developing mineral transporters and looking for and using other orthomolecular substances that could support and repair the outer cell membrane and inner membranes of cell organelles.
- **Optimize membrane structure and function** through use of Nieper mineral transporters. The electrical charge of the cell membrane is maintained both by the structure of the membrane and it's associated minerals, however these minerals must be in the proper location at the proper concentration for optimization of cellular potential and metabolic activity. Mineral transporters serve the function of special delivery vehicles placing minerals in optimal cellular and subcellular locations

(Alexander, 1997a, 1997b; Nieper et al., 1999). Dr. Nieper found this approach improved these membranes natural ability to store electrical charge known as the membrane capacitance function.

- **Capacitors** are well known electronic components that are composed of two conducting sheets or metal plates separated by a thin layer of insulating material known as a dielectric. Cells contain several forms of biological capacitors, which consist of an insulating material (the membrane) covered on both sides by collections of charged dissolved minerals, which serve the same function as a conducting metal plate. Because the exterior cell membrane and the membranes of cell organelles like the mitochondria in animals and the chloroplasts in plants are biological capacitors **they have the capacity to accumulate and store charge and hence energy to be given up when needed**. ***(Would help explain unusual reported instances of unusual strength or Olympic feats, as well as nonlocal energy effects on environment, electronic equipment and other people……J. Beal)*** Since energy is needed to run any type of machinery be it mechanical or biological it makes sense that nutrients that can enhance energy production and energy storage can have profound biological effects.
- **Improvement in cellular bioenergetics can also be enhanced nutritionally** by use of certain nutrients that help provide structural materials for cell membrane repair and facilitation of mitochondrial enzyme production of ATP. Some of the most effective compounds are the mineral transporters aminoethanolphosphates (2-AEP's), orotates, aspartates and arginates developed by Dr. Hans Nieper. 2-AEP mineral transporters enhance cell membrane capacitance in several ways. First by repairing damaged cell membranes and second by effectively delivering minerals to the outer surface of cell membranes. The orotate, aspartate and arginate mineral transporters are advanced mineral delivery systems that effectively deliver minerals into the interior of cells. Mineral delivery into the cell interior is important because many of the cell's cytoplasmic and mitochondrial enzymes require minerals in order to be activated.
- Biological utilization of a mineral encompasses far more than just mineral absorption. Biological utilization of minerals includes mineral absorption, mineral transport in the blood stream and mineral delivery into the cells. Most mineral supplements generally break apart during the processes of digestion releasing ionized minerals into the lumen of the digestive tract, which are then moved into the bloodstream. Just getting a mineral into the blood stream doesn't guarantee that the mineral can be directed to any particular tissue or be transported across the cell membrane to the cell interior (Nieper, 1961, 1966a).
- The joining of carrier molecules with minerals forms electrically neutral compounds that have different transport properties than unbound ionized minerals (Nieper et al., 1999). Calcium orotate, calcium arginate, calcium aspartate, calcium 2-AEP, magnesium orotate, magnesium arginate, potassium arginate, potassium orotate, potassium-magnesium aspartate, zinc orotate and zinc aspartate are all mineral transporters. When these mineral transporters are properly manufactured to be acid resistant, they deliver minerals still bound to the transporter into the alkaline environment of the small intestine where the mineral compounds are absorbed relatively intact from the digestive tract into the blood stream with the mineral still bound to the transporter (Alexander, 1997a, 1997b; Nieper et al., 1999).
- The mineral-transporter complex remains stable in the blood stream with low dissociation, and the minerals are not released until the mineral-transporter complex enters the target tissues/cells. The attachment of minerals to carrier molecules forms electrically neutral stable complexes that allow selective direction of minerals to particular tissues that metabolically use the carrier molecules. This form of directed mineral nutrition even enhances mineral entry even into cells that have disturbed cell

membranes. Use of mineral transporters can increase the bioavailability of minerals to injured and cancerous tissue (Nieper, 1966a, 1966b, 1966c, 1967a, 1967b, 1968, 1969, 1970, 1971, 1973, 1985; Buist, 1972, 1978).

- **Dietary correction of essential intracellular mineral deficiencies** such as potassium, magnesium, zinc and other trace elements is also critically important. An example would be the very similar cancer diets promoted by Dr. Hans Nieper or Dr. Max Gerson. **Dr. Gerson** clinically observed that when cancer patients were responding to treatment they would lose large amounts of sodium in their urine. This observation was one factor that made him theorize that cancer cells accumulate excess amounts of sodium and water and that the use of a high potassium diet could be very beneficial. Dr. Gerson advised his patients to use a program of natural detoxification that involved a diet containing large amounts of potassium. Gerson used large amounts of fresh vegetable juice and calf liver juice, which provides minerals, enzymes and electrons to the body. He believed such a diet would also assist in body detoxification particularly when coffee enemas were used to promote bile flow and bowel cleaning.
- **Cell membrane repair** can be initiated by changing the composition of cell membranes with lipid and sterol compounds such as 2-AEP, essential fatty acids, sterols and phytosterols. According to researchers such as Emanuel Revici, Mary Enig, Hans Nieper and Patricia Kane one of the major things that can be done to promote health is to improve membrane structure and membrane functions through nutritional interventions targeted at manipulating lipids, sterols and minerals.
- Essential fatty acids, phospholipids and sterols act as structural components of the cell membrane. Good sources of essential fatty acids and phospholipids are lecithin (phosphatidyl choline) which is found in eggs and soybeans, phosphatidyl serine, flax oil, avocado oil, walnut oil, hazelnut oil, hemp oil, grape seed oil, sesame oil, fish oil, olive oil, evening primrose oil, borage oil, blackcurrant seed oil, butter, coconut oil and phytosterols. Squalene is a compound found in high concentrations in shark liver oil and to a lesser degree in olive oil. Poor choices of fats are cottonseed oil, soybean oil, corn oil, canola oil, transfatty acids, and any hydrogenated or partially hydrogenated oil. *This pretty much eliminates any baked goods created by food manufacturing companies.*
- **2-AEP** is a nutritional supplement usually bound to calcium (calcium 2-AEP) or calcium, magnesium and potassium (2-AEP complex). 2-AEP is a cell membrane repair molecule that is a precursor of phosphatidyl ethanolamine. 2-AEP helps act as a cell membrane sealant reducing cell entry of toxins and viruses and it helps maintain and improve the electrical potential of cell membranes particularly in cells involved in inflammatory processes (Nieper, 1988). Dr. Nieper reported that people who regularly used AEP mineral transporters along with calcium aspartate or calcium orotate had significantly less rates of prostate, colon and breast cancers.
- **Emanuel Revici** was an unconventional cancer researcher who developed a treatment for cancer called "guided 1ipid" therapy. Revici believed cancer patients had two basic patterns of lipid imbalance either an excess of sterols or an excess of fatty acids. He would test his patients determine, which pattern that they had then he would give either fatty acids or sterols to correct the imbalance (Revici, 1961).
- **Patricia Kane** has pioneered the use of RBC membrane analysis to determine nutritional adjustments specific for that individual.
- **Mary Enig** has extensively written about the role of dietary fats in disease causation and disease prevention.

- **Hans Nieper** developed a series of mineral transporters that such as 2-aminoethanol phosphates (AEP's), orotates, arginates, and aspartates that deliver minerals to specific cellular locations. He also was one of the first doctors to strongly recommend the use of a squalene and a cell membrane repair supplement called AEP for cell membrane repair. Squalene is a naturally occurring polyprenyl compound, structurally similar to beta-carotene, which composes up to 70% of the oils in shark livers. Squalene is an important nutritional compound that in conjunction with AEP, magnesium, zinc, selenium and the amino acid taurine can help stabilize the structure and functions of cell membranes. Squalene has a particular role in cancer and degenerative diseases in that along with AEP it helps support membrane structure and function. Squalene also has important roles in wound healing, immune system regulation and the production of steroid hormones. The body's natural production of dhea and pregnenolone can be increased by ingestion of squalene. These steroid hormones are surveillance hormones having important roles in reducing cancerous transformation in degenerative tissues.

Cellular membrane capacitance and cellular energy production may also be enhanced:

- **By inductively created or conducted electric fields** in specific *frequency and amplitude (amperage) windows and also by acoustic vibrations.*
- A cell or body is coupled to an electric field in proportion to its capacitance such that the greater the frequency of the electrical field the greater the current flow in the cell or body. For soft tissues low frequency natural or applied electrical fields create currents that are conducted primarily along the surface of cells in the ECM-cell membrane interface. Conduction of electrical currents in the ECM is the dominant effect when very low frequency electrical fields are created in or applied to biological tissues.
- When high frequency fields are applied with external signal generators this results in charging of the cell membranes causing an increase in cell membrane capacitance and increased conduction of current through the cell membranes.
- Because cell membranes naturally have capacitance this makes the cell membrane frequency-dependent conductors. At high frequencies a greater percentage of current will flow into and out the cell as a circuit loop. Higher frequency fields can strongly affect cell membrane permeability, which in turn can affect nutrient entry into the cells and toxin release from the cells and the ECM.
- I have done some research with both high frequency multiwave oscillators and experimental whole body phototherapy equipment and I have found that both type I and type II diabetics will have a fall in blood sugar when exposed to these devices. ***A note of caution****, diabetics and cancer patients should only stay in a multiwave oscillator field for 3-5 minutes when they first start because some individuals will have excessive toxin release and a rapid decline in blood sugar.* These individuals need time to clear toxins from their tissue and bloodstream through their organs of elimination. In my experience phototherapy is gentler and the effects produced while just as significant are not as rapid as the effects I have seen with multiwave oscillators. I believe the improvement with glucose control that can be achieved with these types of equipment is related to frequency-induced effects on insulin receptors and cell membrane glucose transport mechanisms.
- In summary an **increase in cellular membrane capacitance** may: change membrane permeability, increase cellular nutrient and mineral entry in to the cell and facilitate release of impregnated toxins from the membrane and cell interior.

Addressing genetic issues

- **The genetic machinery of the cell** controls ECM, glyocalyx, cell membrane, cell membrane receptor and internal cellular macromolecular composition. The genetic machinery of the cell can be altered to an abnormal state by: hereditary factors and environmental factors such as viruses, toxic chemicals, heavy metals, radiation, free radical damage and age-accumulated errors in transcription. Genetic abnormalities include DNA strand breaks, acquired dysfunction of DNA repair mechanisms, mutations in genes that drive the cell to divide, mutations in genes that suppress cell division, and failure to properly code mRNA. If improvements are made in genetic repair and removing genetic toxins the types of proteins, lipids and carbohydrates manufactured by the cell will change. Genetic mutations can by modified by downregulating oncogenes. Genetic repair can be improved by use of nutrients such as folic acid and zinc to increase the activity of DNA transcriptase and Vitamin B12, B6 and methionine to improve DNA methylation (Osiecki, 2002). Other strategies can also be used.
- Dr. Hans Nieper addressed **genetic repair** by use of products such as Dionaea muscipula and Iridodial.
- "Carnivorous plant extracts derived from the Venus Fly-Trap plant contain the active enzymes *endopeptidase* and *endonuclease*. These are special **gene-eliminating substances** (Nieper et al., 1999). Venus Fly-Trap plants excrete substances, which extinguish the gene information of ingested insects because otherwise, the absorbed gene information from the insect would possibly go in their own gene system and change it. The carnivorous plant of the "Venus Fly-Trap" contains about a dozen substances, such as *plumbagin*, *droseron*, and *hydroxydroseron*, which extinguish open gene information. According to Dr. Nieper, the extract of Venus Fly-Trap extinguishes genetic replication of malignant cells. This extract is also useful in eliminating tissue damaged by radiation therapy, while leaving normal cells unaffected. Venus Fly-Trap is botanically termed ***Dionaea muscipula***.
- Iridodials are a primary source of *dialdehydes*, which "are **extremely powerful genetic-repair factors**" (Nieper et al., 1999). Dialdehydes are "lipid soluble agents that can penetrate the lipid membranes of the outer cells of tumours" (Nieper et al., 1999). Iridodial is extremely similar to the activated dialdehyde, called didrovaltrate. Insects and ants in particular and carnivorous plants are "the most effective producers of gene repair substances" (Nieper, 1990). Insects are phylogenetically extremely old. Their ability to conserve and safeguard their gene system is superb. Similar to sharks, they hardly ever develop tumors. They are able to host large amounts of viruses without showing ill effects. Yet insects have no immune system, phylogenesis only equipped them with a repair principle called Iridodial (Nieper, 1990). According to Hans Nieper, the aldehydic iridoides (Iridodial) from insects inhibits viruses from causing genetic alterations (Nieper, 1985). These gene-repairing Iridodials work by inactivating the undesired genetic material from an infecting virus thus protecting the cellular genome. Dr. Peter Thies of Germany first described the anti-malignant, genetic-repair properties of Iridodials in 1985. Also in 1985, Dr. Didier of Gifhorn, Germany first reported pulmonary tumor regression by use of Iridodial (Nieper, 1990).
- Dr. Nieper reported that both Dionaea muscipula and Iridodial could **extinguish cells, which were genetically impaired** (Nieper, 1996). Therefore, cells that were improperly programmed would be discarded (Nieper, 1984). Such undesired information may otherwise result in the conversion of a normal cell into a cancerous cell. Dr. Nieper found that cells already transformed could be induced to die while normal cells were left unaffected. Gene-repair therapy "represents in many ways, an imitation of the cancer defense of our body" (Nieper, 1985).

- Dr. Nieper reported that Iridodial and Dionaea muscipula were completely free of any side effects, and so non-toxic that they could be administered without complication in early and suspected stages of the disease for an unlimited time (Nieper, 1990). Dr. Hans Nieper believed that Iridodial and Dionaea Muscipula outdistanced most other substances for use in cancer. Dr. Nieper reported that his first choice in his nontoxic approach to cancer were the combined use of the extract of Venus Fly-Trap (Dionaea Muscipula) and the ant extract Iridodial (Nieper, 1990; 1996).

Protection of cell membranes, mitochondria and genetic machinery by use of exogenous antioxidants and promotion of the production and regeneration of endogenous intracellular and extracellular antioxidant and Redox systems particularly glutathione pathways.

- Oxygen is required by the metabolic reactions of our cells that obtain energy from the chemical burning of food. In the process of energy production some toxic compounds are normally produced. When energy is produced in the mitochondria of cells some of the oxygen is converted to a variety of free radicals such as superoxide (O2-), hydrogen peroxide (H2O2) and hydroxyl (OH-) radicals. These free radicals are extremely reactive molecules that contain at least one unpaired electron in their outer orbital shell. Body exposure to chemical toxins and radiation also produce free radicals. Unless adequate amounts of cellular and extracellular antioxidants are available these free radicals will begin to damage cellular structures such as the cell membranes, the mitochondria, the nucleic acids of DNA and cellular proteins impairing the ability of the cells to repair themselves and reproduce (Morel et al., 1999).
- When cell membranes are damaged by free radicals their ability to hold an electrical charge (capacitance) and their ability to transport minerals and other nutrients is disrupted. When mitochondria are damaged the cells ability to make energy is impaired. When the genetic code is damaged cells cannot reproduce normal cells. Free radicals also cause lipid peroxidation, which can result in lowering HDL cholesterol and damage to the cell membranes lining blood vessels. When the delicate membranes lining blood vessels are damaged an inflammatory process may result which leads to thickening of blood vessels and arterial plaque. The tissue reactions created by free radicals are now thought to be involved in premature aging, cancer, atherosclerosis, arthritis, immune disorders and other degenerative diseases.
- The redox status of the cells depends on the concentrations of the oxidized (inactive) and reduced (active) components of the major redox molecules, which act as homeostatic redox buffers. For example the ratio of oxidized GSSG to reduced GSH, reflects the redox status within the cell. In healthy cells ratio of GSSG/GSH usually averages 1%, which means that the intracellular concentration of GSH is roughly 100 times greater than the intracellular concentration of its oxidized component GSSG. Any change in this ratio will greatly affect the redox status within the cell). When oxidative conditions occur in injury the oxidized component predominates and genetic activity, cell organelle functions and cell detoxification functions are impaired.

Providing a source of free electrons: a short discussion on the biological effects of electricity and light: chemical antioxidants, electronic antioxidants and photonic antioxidants:

- Free radicals result from both natural biochemical processes and environmental factors, such as exposure to chemical toxins, heavy metals, ultraviolet light, x-rays, radiation therapy, nuclear radioactivity, alcohol and smoking.

- Because free radicals are defined as molecules that have lost an electron they can be said to be electron deficient. These electron deficient molecules then search the body in any attempt to find a replacement that they can steal, so they can also be thought of as electron thieves. The replacement electrons are generally stolen from cell proteins, cellular DNA, or cell membranes. When enough electrons are taken from these cells, the cells are damaged they can then die, under go cancerous transformation or be repaired by an antioxidant. Because free radicals are continuously produced as a natural toxic byproduct of energy production the cells use a variety of antioxidant systems to prevent their accumulation. Antioxidants are life's free radical scavengers. The cellular antioxidants are chemical compounds that have the ability to supply the electron-deficient free radicals with electrons, therefore neutralizing their oxidative destruction of the cells biomolecules. The key element is that antioxidants supply electrons.
- From a biologist's point of view antioxidants are biological chemicals that are able to donate some of their own electrons to neutralize electron-deficient free radicals. Conventional wisdom typically holds that antioxidants have to be nutritive substances, however from a physicist's point of view antioxidant effects can also be achieved by other methods.
- New research has shown that external electronic devices such as microcurrent machines, low power lasers, LEDS, and infrared lamps can also supply electrons. This is the concept of electronic and photonic antioxidants by using physiologically acceptable wavelengths of light (visible and far infrared light) or providing electrical currents in the microcurrent range through application of DC electricity by microcurrent devices.
- Due to tissue interactions with the photons of light (the photoelectric effect), when light of the right frequency (far infrared or visible light) interacts with biological tissues electrons are produced. At a fundamental level a nutrient antioxidant is simply a chemical carrier of extra electrons and the same effect of providing extra electrons by chemical means can be also achieved by exposure to the photons of far infrared or visible light. Far infrared and visible light are bands of electromagnetic energy, which are particularly acceptable and beneficial to living creatures. This photonic antioxidant effect provides part of the explanation of how the "vital rays" of far infrared and visible light are involved in healing.
- In addition the use of these devices in cancer helps reestablish biocurrent flow in electrically resistive tissue reducing the resistance of the cancerous tissue and facilitating a more normal capacitance. **Warning: microcurrents and PEMF devices should not be used on pregnant women or people with pacemakers**.

Microcurrent electrical therapy and PEMF therapy

- **Microcurrent devices** deliver weak electrical currents directly to the tissues through the use of needle implants or attached electrodes.
- **A PEMF device** applies a magnetic field to the body, which *induces the production* of weak electrical currents in the tissues. As previously stated these weak biocurrents can influence the flow of blood and oxygen to the tissues and the flow of ions and of nutrients into the cells. This enhancement of circulation and nutrient exchange can be beneficial in improving cellular bioenergetics.
- Doctors, chiropractors, dentists, physical therapists and other practitioners currently use microcurrent electrotherapy for a variety of clinical conditions. In fact it is a rapid treatment for many pain-related disorders because it can provide fast relief of symptoms and promote faster tissue healing. The advantages of micro current electrotherapy are multiple. It has significantly

less side effects than drugs. In many cases it can give symptom relief in minutes and it supports cellular repair processes unlike many pharmacological agents that can have toxic effects when used long term for chronic conditions.

- The first modern acceptable electrotherapy devices to receive wide medical utilization were transcutaneous nerve stimulation devices called TENS units. TENS devices use a small current of electricity in the milliamp range at low frequencies typically eight cycles per second or less to block the body's ability to perceive the pain (Leo et al., 1986).
- TENS devices are believed to stimulate A-beta pain-suppressing nerve fibers to overwhelm chronic pain-carrying C fibers and to release endorphins (Melzack and Wall, 1965; Mercola and Kirsch, 1995). According to Dr. Mercola, for TENS devices to be effective they require that the current be strong enough to feel. “Patients are advised to set the current at the maximum comfortable tolerance, but the nervous system gradually accommodates to this high level of current, causing tolerance similar to that of chemical analgesics. Increasing the current causes mild electrical burns in about one third of the patients. The technique provides no significant residual effect (Mercola and Kirsch, 1995).”
- Microcurrent devices use a current of lower intensity in the microampere range with a longer pulse width. The currents that microcurrent devices use are 1000 times less than milliampere range of TENS with pulse widths 2500 times longer than the pulse in a typical TENS unit (Mercola and Kirsch, 1995).
- Unlike TENS devices microcurrent devices help stimulate cellular and tissue repair processes by using electrical currents in the physiological range used by the body. Administration of electric current in physiologic ranges by microcurrent devices have a number of advantageous cellular effects including: increasing ATP generation by almost 500%, enhancement of amino acid transport through the cell membranes and increasing cellular protein synthesis (Cheng et al., 1986). It is also likely that cell membrane transport of minerals is also enhanced because microcurrent devices help correct the reduced cellular capacitance of damaged cells and increase the reduced electrical conductance of injured tissue. Injured tissue begins to heal faster when cellular energy production increases, the cells regain normal capacitance and the tissues regain normal conduction of electrical currents (Becker, 1985; Vodovnik and Karba, 1992) allowing reestablishment of normal communication with the rest of the body through the liquid crystal connective tissue communication system (Ho, 1998).

Ensure adequate hydration

Initiate autorepair mechanisms by removal of energetic blockages (acupuncture, homeopathy, neural therapy, infrared emitters, phototherapy devices, microcurrent devices, pulsed electromagnetic field devices etc.)

Detoxification of toxic chemicals and heavy metals in the ECM by massage, oral and IV chelation, infrasonic devices, ultrasonic devices, infrared devices, phototherapy devices, and microcurrent devices. Many clinicians use detox strategies that mobilize toxins and promote excretion through skin (infrared saunas), liver-GI tract, and kidneys.

Improving cellular oxygen levels by opening up the microcirculation with enzymes like bromelain, papain, pancreatin and nattokinase and oral and IV EDTA. Increasing tissue oxygen levels with ozone therapy and hyperbaric oxygen.

Change the composition of the ECM/glycocalyx/cell membrane interface with compounds like glyconutrients that help change the composition and charge of proteoglycans and the composition and activity of cell receptors. Possible nutrients include Betaglucans, IP-6, Aloe vera extracts, arabinogalactans, glucosamine, polysaccharides derived from mushrooms and alginates.

Use of cell therapy: cell therapy may be provided orally or by implantation

- Active cell therapy research is now taking place with the implantation of stem cells such as mesenchymal cells, which can differentiate into osteoblasts, chondroblasts, myoblasts and fibroblasts.
- Cell therapy is also available with oral glandular products that provide organ specific components. These organ specific components supply a unique form of nutrition to organ cells that is different from oral and IV nutrient programs.
- Cell therapy can help balance hormone production by the endocrine glands when a preexisting endocrine deficiency exists.

In closing the goals to work toward in electronic cancer nutrition:

1. Intervene nutritionally at the level of the ECM-glycocalyx-cell membrane level with enzymes.
2. Repair cell membranes and cell membrane potential with proper selections of fats, sterols, phytosterols, AEP, squalene, and mineral transporters.
3. Improve cell signaling mechanisms (role of glyconutrients)
4. Correct imbalances in intracellular minerals that are needed for maintenance of cell membrane capacitance and enzyme cofactors by utilizing mineral transporters
5. Correct DNA breaks and DNA repair mechanisms with gene support nutrients, vitamin B12, B6, folic acid, cell therapy implants, gene repair extracts (Dionaea muscipula and Iridodial).
6. Improve macromolecular production, utilization and secretion of proteins (enzymes and structural proteins), peptide (hormones, growth factors, growth inhibitors and cytokines), lipids and carbohydrates (energy source and signaling molecules).
7. Improve intracellular energy production with vitamins, carnitine, coenzyme Q10, intracellular mineral transporters.
8. Correct pH alterations with diet.
9. Facilitate antioxidant functions.
10. Facilitate detoxification of the ECM and intracellular compartments.

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I hope you will have found this monograph useful and thought provoking. At this time this material is a work in progress and I would appreciate feedback and corrections.

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On the use of microcurrent to treat cancer patients (pgs 113-129)

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Methods and systems for administering microcurrent therapy for treatment and prevention of side effects associated with cancer treatment

Abstract

Methods and systems apply biphasic DC signal at various frequencies, durations and/or amplitudes to areas of a cancer patient's body being targeted for preventing or alleviating cancer-therapy side effects. Microcurrent therapy can be provided prior to, during and after procedures used to treat cancer. During microcurrent treatment a biphasic DC signal can be applied from a microcurrent therapy system to an area of the cancer patient's body targeted for microcurrent treatment using at least one electrode. The electrode can be actively manipulated on the treatment area for a predetermined time. The system can provide impedance matching between it and the patient during treatment. A feedback module provides a controller impedance information between the patient and system where a mismatch is used to adjust the system to overcome impedance variations that occur between said system and said patient's body during the predetermined time of treatment.

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Goverment Interests

[0002] The United States government has certain rights to the present disclosure in accordance with contract DE-AC02-76CH03000 with the U.S. Department of Energy.

Claims

1. Method of applying biphasic DC signal at various frequencies, durations and/or amplitudes to areas of a cancer patient's body being targeted for microcurrent therapy, comprising the steps of: apply a biphasic DC signal to an area of a cancer patient's body targeted for microcurrent treatment using at least one electrode; actively manipulate said at least one electrode to said area of a cancer patient's body for a predetermined time; and adjust the biphasic DC signal during said predetermined time. wherein said method is provided to a patient at least one of prior to the patient undergoing cancer treatment or concurrently with a patient undergoing cancer treatment.

2. The invention of claim 1 wherein said method is also provided after a patient receives cancer treatment.

3. The method of claim 1 wherein microcurrent is provided to a patient at frequencies in the range of about 0.5 Hz to about 500 Hz.

4. The method of claim 1 wherein microcurrent is provided to a patient in the range of about 25 microamps to about 600 microamps.

5. The method of claim 1 wherein microcurrent is provided to a patient for a period up to about 60 minutes.

6. The invention of claim 1, further comprising the steps of: receiving impedance matching information through said microcurrent therapy system during said predetermined time; analyzing said impedance matching information to identify impedance variations between said system and said patient's body; and adjusting the biphasic DC signal to compensate for impedance variations between said microcurrent therapy system and the patient.

7. The invention of claim 6 wherein said method is provided prior to a patient undergoing cancer treatment.

8. The invention of claim 6 wherein said method is provided concurrent with a patient undergoing cancer treatment.

9. The invention of claim 6 wherein said method is provided after a patient receives cancer treatment.

10. Methods of applying biphasic DC signal at various frequencies, durations and/or amplitudes to areas of a cancer patient's body being targeted for microcurrent therapy, comprising the steps of: applying a biphasic DC signal from a microcurrent therapy system to an area of a cancer patient's body targeted for microcurrent treatment using at least one electrode; actively manipulating said at least one electrode to said area of a cancer patient's body for a predetermined time; receiving impedance matching information through said microcurrent therapy system during said predetermined time; analyzing said impedance matching information to identify impedance variations between said system and said patient's body; and adjusting the biphasic DC signal in response to said impedance variations.

11. The method of claim 10 wherein microcurrent is provided to a patient at frequencies in the range of about 0.5 Hz to about 500 Hz.

12. The method of claim 10 wherein microcurrent is provided to a patient in the range of about 25 microamps to about 600 microamps.

13. The method of claim 10 wherein microcurrent is provided to a patient for a period up to about 60 minutes.

14. The invention of claim 10 wherein said method is provided prior to a patient undergoing cancer treatment.

15. The invention of claim 10 wherein said method is provided concurrent with a patient undergoing cancer treatment.

16. The invention of claim 10 wherein said method is provided after a patient receives cancer treatment.

17. A system for applying biphasic DC signal at various frequencies, durations and/or amplitudes to areas of a cancer patient's body being targeted for microcurrent therapy, comprising: a pulsed biphasic DC generator in electrical communication with a controller and at least one electrode; a user interface, said user interface for enabling a user to provide manual settings and adjustments of biphasic DC signals provided by said system; a controller, said controller adapted to receives manual setting from said user interface and further adapted to automatically adjust biphasic DC signal attributes including amplitude and frequency in response to measurements obtained from a feedback module; and a feedback module in communication with said controller, said feedback module adapted to measure impedance variations between said system and a cancer patient during microcurrent therapy, wherein said impedance variations are obtainable by said controller.

18. The system of claim 17, said at least one electrode includes at least one of a: probe, roller, plate, cuff, clamp, sheet, and liquid.

19. The system of claim 17 wherein said at least one electrode is adapted to apply microcurrent to a patient at at least one of: large

bodily areas, small bodily areas, crevicular bodily areas, and intra-oral bodily areas.

20. The system of claim 19, said at least one electrode comprising of at least one of a: probe, roller, plate, cuff, clamp, sheet, and liquid.

21. The invention of claim 10 wherein said system is used for the application of biphasic DC signals at various frequencies, durations and/or amplitudes prior to a patient undergoing cancer treatment.

22. The invention of claim 10 wherein said system is used for the application of biphasic DC signals at various frequencies, durations and/or amplitudes concurrently with a patient undergoing cancer treatment.

23. The invention of claim 10 wherein said system is used for the application of biphasic DC signals at various frequencies, durations and/or amplitudes after a patient receives cancer treatment.

Description

PRIORITY TO PREVIOUSLY FILED APPLICATION

[0001] This application claims the benefit of priority to a provisional patent application, Ser. No. 60/407,093, filed on Aug. 30, 2002, and entitled "methods and systems for administering and monitoring results of microcurrent therapy administered to cancer patients for treatment and prevention of side effects associated with cancer treatment."

FIELD OF THE INVENTION

[0003] The present invention generally relates to treatments that address the side effects of cancer therapy. The present also relates to the administration of microcurrent therapeutic techniques for relieving the toxicities associated with cancer therapy. More particularly, the present invention is related to methods and systems for administering, and monitoring, microcurrent therapy provided to cancer patients for the treatment and prevention of at least one of many medical conditions associated with cancer and its treatment. Medical conditions subject to treatment under the present invention can include those associated with radiation treatment, chemotherapy treatment and cancer-related surgery, including: radiation-induced fibrosis; xerostomia; trismus; proctitis (including associated diarrhea); nausea; limited range of motion; loss of motor coordination; edema, lymphedema, scar tissue, and trismus.

BACKGROUND OF THE INVENTION

[0004] All forms of cancer treatment are associated with some type of side effect. Scars caused by surgery, and nausea and/or hair loss caused by chemotherapy tend to be self limiting once the cancer treatment is completed. However, while the acute effects of radiation

therapy tend to improve with time, the late effects of radiation, especially fibrosis, can continue to worsen with time.

[0005] Radiation therapy uses penetrating beams of radiation to treat or remediate disease. Various forms of radiation therapy, including photon, electron, and neutron radiation, are used on a daily basis in the United States and throughout the world. One major use of radiation therapy is in the treatment of cancerous tumors. The basic effect of radiation therapy is to destroy the ability of cells to divide and grow by damaging their DNA strands. This effect is useful in killing cancerous cells, but also has the disadvantage of damaging healthy tissue. As a result, a patient may be required to live with debilitating side effects of cancer treatment including limb or organ swelling, thickening and hardening of otherwise normal tissue, and chronic or constant pain.

[0006] The deleterious side effects produced in the patient as a result of radiation therapy are known as radiation toxicities. Radiation toxicities are associated with any ionizing radiation treatment and include fibrotic tissue (scar tissue), xerostomia (loss of salivary function), trismus (closure of the jaw), radiation proctitis (inflammation of the rectum), limited range of motion, loss of motor coordination, edema (swelling), and lymphedema (swelling resulting from obstruction of the lymphatic vessels or lymph nodes). Unfortunately, late effects associated with radiation therapy are progressive and in most cases will tend to worsen over time. Current practices for treating late side effects of cancer treatment include physical therapy, massage, exercise, and drugs such as diuretics, painkillers, steroids, and saliva inducers. In most cases, however, such treatments can only provide patients with minimal relief. Patients will most likely be required to live with the debilitating side effects of radiation therapy or the chemical and/or biological side effects of medicinal therapies used to treat radiation side effects.

[0007] For example, salivary glandular tissue is often included in radiation treatment fields involving head and neck cancer. Damage to saliva glands can cause xerostomia (dry mouth), leading to an increase in dental caries, oral yeast infections, and difficulty in digesting food. Patients suffering from xerostomia frequently carry water bottles or use sour candy to keep their mouths moist. The most common medication for relieving dry mouth is pilocarpine hydrochloride. Patients using pilocarpine must take it daily for about 90 days to achieve improvement and they lose the benefit when they stop taking the drug. The cost of the drug as well as the side effects of sweating and gastrointestinal distress, often cause patients to discontinue use of the drug.

[0008] The use of electrical stimulation for simple pain relief, not associated with cancer or radiation therapy, has been well established by physical therapy centers. Physical therapists use microcurrent therapy in a variety of ways for the treatment of pain not associated with cancer or radiation treatment, often in combination with massage, heat and physical manipulation. There are many commercially electrical stimulation devices marketed for the treatment of pain relief, most of which are commonly referred to as TENS (transcutaneous electrical nerve stimulation) units. Typical TENS units emit electrical pulses with alternating positive and negative polarities in the 10 to 500 kilohertz (KHz) range and currents in the milliampere (mA) range. Microcurrent (.mu.A) units are often incorrectly referred to as TENS units, but microcurrent units deliver lower currents (microampere range) and lower frequencies (0.5 to several hundred Hertz). In general, units using higher current and frequencies are more effective at blocking acute pain, but the pain relief is not lasting. By contrast, microcurrent therapy using lower frequencies requires longer treatment times to achieve pain relief, but the relief can endure for many hours after the treatment has terminated.

[0009] The present inventor has previously recognized that a need existed in the medical profession for a more effective means of alleviating radiation toxicities typically associated with radiation therapy. In U.S. Pat. No. 6,115,637, entitled "microcurrent therapeutic technique for treatment of radiation toxicity," issued Sep. 5, 2000, and herein incorporated by reference, the present inventor previously disclosed methods for alleviating radiation toxicities associated with radiation therapy. As described in the patent, a sinusoidally pulsed biphasic DC signal can be applied to an affected bodily area using at least one electrode. The electrode can be manipulated using active tactile manipulation for a predetermined time and the frequency of the sinusoidally pulsed biphasic DC signal can be adjusted during the course of the treatment. The patent also describes a method of applying a spiked pulsed biphasic DC signal to an affected bodily area using at least one electrode. The electrode can also be manipulated using active tactile manipulation for a predetermined time and the frequency of the spiked pulsed biphasic DC signal can also be adjusted during the course of the treatment.

[0010] The microcurrent therapeutic techniques described in the '637 patent are used to alleviate debilitating radiation toxicities associated with radiation therapy, including fibrotic tissue, xerostomia, trismus, radiation proctitis, limited range of motion, loss of motor coordination, edema, and lymphedema. An objective set forth in the '637 patent is to provide greater pain relief than prior known methods for treating the late side effects of cancer treatment, thus allowing patients to have higher qualities of life. The patent also describes use of methods for pre-treating a patient in an effort to avoid the radiation toxicities associated with radiation therapy.

[0011] Since disclosing the patented use of microcurrent therapy treatment of toxicities associated with radiation cancer treatment, the present inventors have determined that a need still exists for disclosure of new and improved treatment regimes, via improved methods and systems, that can be used to accurately target and treat, pre-treat, and concurrently treat areas on the human body that can fall ill as a result of cancer therapies. The present inventors therefore now disclose new methods and systems for managing medical conditions associated with cancer treatment including: medical conditions associated with radiation treatment, chemotherapy, and cancer-specific surgery. Medical conditions subject to treatment include: radiation-induced fibrosis; xerostomia; trismus; surgical scars; proctitis (diarrhea); nausea associated with radiation treatment and chemotherapy; limited range of motion; loss of motor coordination; edema, and lymphedema. The new methods described herein include methods for applying microcurrent treatment before cancer therapy, concurrent with cancer therapy and after cancer therapy in order to minimize side effects.

SUMMARY OF THE INVENTION

[0012] The following summary of the invention is provided to facilitate an understanding of some of the innovative features unique to the present invention and is not intended to be a full description. A full appreciation of the various aspects of the invention can only be gained after considering the entire specification, claims, drawings and abstract as a whole.

[0013] Side effects suffered by cancer treatment patients can be prevented and/or treated by the application of microcurrent therapeutic techniques. Set forth herein are methods and systems for applying biphasic DC signal at various frequencies and

amplitudes to areas of a cancer patient's body being targeted for microcurrent therapy. The methods and systems described herein are effective for relieving toxicities associated with cancer therapy. Spiked and/or sinusoidally pulsed biphasic DC signal can be applied to the affected bodily area using active tactile manipulation by at least one electrode for a predetermined time and adjusting the frequency range during the course of the pre-treatment, concurrent treatment and/or post-treatment of radiation therapy cancer patients.

[0014] A system used to provide DC signal and frequency signaling can include impedance matching capabilities, wherein system output is adjusted to changes in human body impedance during treatment. The biphasic DC signal can be applied to the patient's body using at least one electrode for a predetermined time. Obviously use of at least one electrode implies that the patient is electrically grounded by means known in the art (e.g., conductive cuffs, conductive-adhesive pads, conductive plates, liquid baths, etc.).

[0015] The frequency of the biphasic DC signal used during treatment can be adjusted within a range of from about 0.5 Hz to about 500 Hz. The biphasic DC signal treatment can be applied for a predetermined time, preferably for about 20 minutes per treatment mode (e.g., spiked and sinusoidal). Current used during treatment can range from about 25-600 microamps.

[0016] Preferably, the size of the electrodes used to apply both the sinusoidally pulsed biphasic DC signal and the spiked pulsed biphasic DC signal will be selected so as to achieve maximum skin contact over the largest possible area of the body being targeted for treatment. Electrodes used to apply the sinusoidally and spiked pulsed biphasic DC signal can be provided in the form of any of a: probe, roller, adhesive pad, plate, cuff, clamp, sheet, and other conductive media known in the art. The electrodes used to apply both currents can also be selected for treating larger affected bodily areas, smaller affected bodily areas, or crevicular areas. Electrodes can also be cylindrical in shape or can be designed to be suitable for intra-oral manipulation and rectal and/or vaginal insertion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The accompanying figures, in which like reference numerals refer to identical or functionally-similar elements throughout separate views and which are incorporated in and form part of the specification, further illustrate the present invention and together with the detailed description of the invention serve to explain the principles of the present invention.

[0018] FIG. 1 is an illustration of a flow chart of a method for administering microcurrent therapy to a patient;

[0019] FIG. 2 is an illustration of another flow chart of a method for administering microcurrent therapy to a patient;

[0020] FIG. 3 is an illustration of yet another flow chart of a method for administering microcurrent therapy to a patient;

[0021] FIG. 4 is an illustration of another flow chart of a method for administering microcurrent therapy to a patient;

[0022] FIG. 5 is an illustration of a system that can be used for providing microcurrent for patient therapy in accordance with embodiments the present invention;

[0023] FIG. 6 is an illustration of an electrotherapy treatment technique where a microcurrent therapy patient's hands are allowed to rest on large metal plates while impedance-controlled microcurrent therapy is delivered using a metal roller;

[0024] FIG. 7 is an illustration of a flow chart for administering sinusoidal microcurrent therapy to a patient suffering from neck and/or head fibrosis;

[0025] FIG. 8 is an illustration of a flow chart for administering spiked microcurrent therapy to a patient suffering from neck and/or head fibrosis;

[0026] FIG. 9 is a graphical illustration of the range of cervical rotation over time for three microcurrent therapy patients initially experiencing severe range-of-motion limitations;

[0027] FIG. 10 is a graphical illustration of the range of cervical extension/flexion over time for three microcurrent therapy patients initially experiencing severe range-of-motion limitations;

[0028] FIG. 11 is a graphical illustration of range of cervical lateral flexion over time for four microcurrent therapy patients initially experiencing severe range-of-motion limitations;

[0029] FIG. 12 is an illustration of a flow chart for administering sinusoidal microcurrent therapy to a patient suffering from xerostomia;

[0030] FIG. 13 is an illustration of a flow chart for administering spiked microcurrent therapy to a patient suffering from xerostomia;

[0031] FIG. 14 illustrates the use of a Therabite scale to measure the oral opening ability of a patient's mouth.

DETAILED DESCRIPTION

[0032] The particular values and configurations discussed in these nonlimiting examples can be carried and are cited merely to illustrate at least one embodiment of the present invention and are not intended to limit the scope of the invention.

[0033] Referring to FIG. 1, a flow diagram is provided that illustrates steps of a treating a patient with microcurrent therapy using a sinusoidally pulsed biphasic DC signal. Prior to treatment, a conductive medium such as a conductive gel or saline solution can optionally be applied to the affected bodily area on the patient, as shown in block 102. Conductive media can enhance the transfer of

current and associated signals to a patient. Some applications may not require conductive media such as conductive-adhesive pads, which already include a conductive medium. Conductive gel can enhance the transfer of current and associated signals through the patient. As shown in block 104, a sinusoidally pulsed biphasic DC signal can be applied to the affected bodily area using at least one electrode. The at least one electrode can be actively manipulated for a predetermined time during treatment, as shown in block 106.

[0034] It should be appreciated that a patient can be placed into contact with electrodes that provide passive exposure to microcurrent; however, the best results for microcurrent treatment have been demonstrated through active manipulation of at least one electrode. It should be further appreciated that block 106 can also refer to treatment wherein the time period between manipulation can be on the order of several minutes. Although treatment times can vary, treatment for about 20 minutes has proven effective in prior testing by the inventors. The frequency and amplitude of the sinusoidal pulsed biphasic DC signal can be adjusted during the course of treatment, as shown in block 108. A frequency range shown effective in prior testing is from about 0.5 Hz up to about 500 Hz. Current can range from 25 up to about 600 microamps. Frequency and amplitude adjustments can be made downward or upward. Referring to FIG. 2, a flow diagram is provided that illustrates steps of a treating a patient with microcurrent therapy using both spiked and sinusoidally pulsed biphasic DC signals. Prior to treatment, a conductive gel can be optionally applied to the targeted bodily area on the patient, as shown in block 102. As shown in block 104, a sinusoidally pulsed biphasic DC signal can be applied to the affected bodily area using at least one electrode. The at least one electrode can be actively manipulated for a predetermined time during treatment, as shown in block 106. It should be appreciated that a patient can be placed into contact with electrodes that provide passive exposure to microcurrent; however, the best results for microcurrent treatment have been demonstrated through active manipulation of at least one electrode. It should be further appreciated that block 106 can also refer to treatment wherein the time period between manipulation can be on the order of several minutes. Although treatment times can vary, treatment for about 20 minutes has proven effective in prior testing by the inventors.

[0035] The frequency and amplitude of the sinusoidal pulsed biphasic DC signal can be adjusted during the course of treatment, as shown in block 108. A frequency range shown effective in prior testing is from about 0.5 Hz to about 500 Hz. Current can range from 25 up to about 600 microamps. Adjustments can be made downward or upward. Prior to ongoing treatment, a conductive gel can be re-applied to the affected bodily area on the patient after block 108, as previously described with respect to block 102. As shown in block 110, a spiked pulsed biphasic DC signal can be applied to the affected bodily area using at least one electrode. The at least one electrode can be actively manipulated for a predetermined time during treatment, as shown in block 112. Although treatment times can vary, treatment for about 20 minutes has proven effective in prior testing by the inventor. The frequency and amplitude of the spiked pulsed biphasic DC signal can be adjusted during the course of treatment, as shown in block 114. As with the sinusoidal biphasic signal, a frequency range shown effective in prior testing is from about 0.5 Hz up to about 500 Hz. Current can range from 25 up to about 600 microamps. Frequency and amplitude adjustments can be made downward or upward.

[0036] Referring to FIG. 3, a flow diagram is provided that illustrates steps of a treating a patient with microcurrent therapy. Prior to treatment, a conductive gel can optionally be applied to the affected bodily area on the patient, as shown in block 202. As shown in block 204, a spiked pulsed biphasic DC signal can be applied to the affected bodily area using at least one electrode. The at least one

electrode can be actively manipulated for a predetermined time during treatment, as shown in block 206. It should again be appreciated that a patient can be placed into contact with electrodes that provide passive exposure to microcurrent; however, the best results for microcurrent treatment have been demonstrated through active manipulation of at least one electrode. It should be further appreciated that block 206 can also refer to treatment wherein the time period between manipulation can be on the order of several minutes. Although treatment times can vary, treatment for about 20 minutes has proven effective in prior testing by the inventor. The frequency and amplitude of the spiked pulsed biphasic DC signal can be adjusted during the course of treatment, as shown in block 208. A frequency range shown effective in prior testing is from about 0.5 Hz to about 500 Hz. Current can range from 25 microamps up to about 600 microamps. Adjustments can be made downward or upward.

[0037] Referring to FIG. 4, a flow diagram is provided that illustrates steps of a treating a patient with microcurrent therapy using both spiked and sinusoidally pulsed biphasic DC signals. Prior to treatment, a conductive gel can be optionally applied to the affected bodily area on the patient, as shown in block 202. As shown in block 204, a spiked pulsed biphasic DC signal can be applied to the affected bodily area using at least one electrode. The at least one electrode can be actively manipulated for a predetermined time during treatment, as shown in block 206. It should yet again be appreciated that a patient can be placed into contact with electrodes that provide passive exposure to microcurrent; however, the best results for microcurrent treatment have been demonstrated through active manipulation of at least one electrode. It should be further appreciated that block 206 can also refer to treatment wherein the time period between manipulation can be on the order of several minutes. Although treatment times can vary, treatment for about 20 minutes has proven effective in prior testing by the inventor. The frequency and amplitude of the spiked pulsed biphasic DC signal can be adjusted during the course of treatment, as shown in block 208. A frequency range shown effective in prior testing is from about 0.5 Hz to about 500 Hz. Current can range from 25 up to about 600 microamps. Adjustments can be made downward or upward. After treatment with the spiked pulsed biphasic DC signal is completed, treatment using a sinusoidally pulsed biphasic DC signal can be provided.

[0038] A conductive gel can be applied to the affected bodily area on the patient prior to sinusoidal treatment shown in block 210, as previously described with respect to block 202. Conductive gel can enhance the transfer of current and associated signals through the patient. As shown in block 210, a sinusoidally pulsed biphasic DC signal can be applied to the targeted bodily area using at least one electrode. The at least one electrode can be actively manipulated for a predetermined time during treatment, as shown in block 212. Although treatment times can vary, treatment for about 20 minutes has been proven effective in prior testing by the inventors. The frequency and amplitude of the sinusoidal biphasic DC signal can be adjusted as shown in block 214. As with the spiked biphasic signal, the frequency range of the sinusoidal biphasic signal that has been shown effective in prior testing is from about 0.5 Hz up to about 500 Hz. Current can range from 25 to about 600 microamps. Frequency and amplitude adjustments can be made downward or upward.

[0039] It is well known that the body's impedance changes when electrical current passes through it. The more sophisticated devices used for providing microcurrent therapy for simple pain relief contain circuitry that monitors impedance and adjusts the output current to compensate for changes. Such devices can also deliver fast rise time pulses that can affect voltage-sensitive sodium and calcium ion

channels. Referring to FIG. 5, a block diagram of a system 500 that can be used to deliver impedance-controlled microcurrent therapy for cancer/radiation patients is shown. The system 500 can include a controller 505, a signal generator 510 capable of providing a broad range of signal-types, frequencies and amplitudes consistent with the provision of microcurrent therapy as described further herein, and a user interface 520. Signals provided by the signal generator 510 will preferably be biphasic direct current (DC) signals. The system 500 can be adjusted at the user interface (UI) 520 to deliver signals having fast rise time pulses from the signal generator 510. The system 500 can also include a feedback module 515 for measuring impedance variations between it and a human body during microcurrent therapy. Impedance variations acquired by the feedback module can be used by the controller 505 to adjust signals rendered by the signal generator 510. The system 500 can adjust the effectiveness of its signals provided to target bodily areas of a cancer patient using electrodes 525. Cancer/radiation patients can be treated using microcurrent methods described herein via conductive electrodes 525, which can also be provided in the form of probes (among other media).

[0040] Patients who experience late effects of radiation therapy for head-and-neck cancer can be treated with microcurrent therapy systems and methods. Objective range-of-motion (ROM) measurements can be carried out for cervical rotation, extension/flexion, and lateral flexion before therapy, during and after therapy using the monitoring system described herein. The present inventor has developed methods of treatment using microcurrent systems and has also developed and used a measuring system to monitor patient improvement at the end of each microcurrent treatment. Treatment can preferably be provided using impedance-controlled systems.

[0041] At the end of a course of microcurrent therapy, 92% of twenty-six patients in a study conducted by the present inventor exhibited improved cervical rotation, 85% had improved cervical extension/flexion, and 81% had improved cervical lateral flexion. Of patients returning for a three-month follow-up therapy, 91% maintained cervical rotation range of motion greater than their pre-therapy measurements. Eighty-two percent maintained improved cervical extension/flexion, and 77% maintained improved lateral flexion. When the range-of-motion measurements were stratified by pretreatment severity (severe, moderate, mild, or a-symptomatic) it was observed that the degree of improvement directly correlated with severity. Patients who had more severe initial symptoms experienced a higher percentage of improvement than those with milder symptoms. For these patients the cervical rotation ROM changed from a baseline of 59.+-.12 degrees to 83.+-.14 degrees at three months; flexion/extension improved from 47.+-.10 to 73.+-.13 degrees; and lateral flexion went from 31.+-.7 to 48.+-.9 degrees. Some patients also reported improvement in symptoms such as tongue mobility, facial asymmetry, xerostomia, cervical/facial muscle spasms, trismus, and soft-tissue tenderness. No adverse effects resulting from the microcurrent therapy were observed.

[0042] FIG. 6 shows a treatment technique for applying microcurrent therapy to a patient. Referring to FIG. 7, a flow diagram sets forth steps that can be taken to apply microcurrent therapy to patient suffering from fibrosis of the neck and/or head. A system such as that described in FIG. 5 can be used for delivering microcurrent up to about 600 microamps, at various frequencies (e.g., spiked/sinusoidal pulsed biphasic) in the range of 0.5 Hz to 500 Hz, and at various durations (e.g., about 20 minutes).

[0043] As shown in block 1102 of FIG. 7, a conductive medium can be applied to the patient's neck and or head area in order to enhance conductivity. Then as shown in block 1104, a sinusoidally pulsed biphasic DC signal can be applied to the neck/head areas

using a roller-type electrode, although it should be appreciated that other conductive electrodes can be used. The roller electrode should preferably be smooth enough, or rotate freely enough, to be maneuvered comfortably over a patient's neck area. As shown in block 1106, the electrode (probe) can be manipulated over the patient's neck for a predetermined time. Generally a 10-20 minute treatment is within a comfortable range for most patients. Finally, as shown in block 1108 the frequency of the sinusoidal signal can be adjusted during the course of treatment. Frequency an be varied within a 0.5-500 Hz range, and applied current during treatment can be up to about 600 microamps.

[0044] Referring to FIG. 8, a flow diagram sets forth steps that can be taken to apply microcurrent therapy to patient suffering from fibrosis of the neck and/or head. As shown in block 1202, a conductive medium can be applied to the patient's neck and or head area in order to enhance conductivity. Then as shown in block 1204, a spiked pulsed biphasic DC signal can be applied to the neck/head areas using a roller-type electrode, although it should be appreciated that other conductive electrodes can be used. The roller electrode should preferably be smooth enough, or rotate freely enough, to be maneuvered comfortably over the patient's neck area. As shown in block 1206, the electrode (probe) can be manipulated over the patient's neck for a predetermined time. Generally a 10-20 minute treatment is within a comfortable range for most patients. Finally, as shown in block 1208 the frequency and amplitude of the spiked signal can be adjusted during the course of treatment. Frequency can be varied within a 0.50-500 Hz range, and applied current during treatment can be up to about 600 microamps.

[0045] During the inventor's treatment of patients in a study, alternating microampere current at frequencies ranging from 0.5 to 100 Hz was directed through the fibrotic area using one stationary and one moveable electrode. The current source was an Electro-Myopulse 75F, a commercially available instrument, in mode 1 operated at the auto setting. Current was set as high as the patient could tolerate, typically at the maximum instrument setting of about 600 microamps.

[0046] During the first twenty minutes of each treatment session the fixed electrode was taped to the shoulder blade closest to the affected tissue. This electrode was a flat, square conducting plate of area 5.times.5cm.sup.2. The movable electrode was a cylindrical roller, 7.6 cm in diameter and 7.6 cm long. The roller was repeatedly moved slowly from a region of healthy tissue just outside the fibrotic area into and across the region of scar tissue. For each patient all of the scar tissue related to radiation therapy was treated in this manner. Thus, if a supraclavicular radiation therapy field had been given in addition to the primary treatment fields, the supraclavicular area was included in the microcurrent treatment area.

[0047] During the next ten minutes the current source was the Electro-Acuscope 80L in mode 1 with settings of 10 Hz and 600 microamps. The single fixed electrode was replaced by two rectangular plates, each having an area of 10.times.27.2 cm.sup.2, and connected to the current source through a preamplifier. The patient held one hand on each plate while the therapist treated the fibrotic area with the roller in the manner described above.

[0048] Twenty-six patients were treated twice per day, with a four to five hour interval between treatment sessions. A total of ten treatments were given over a period of five days. Subjective symptoms were recorded and range-of-motion measurements were made

before the first treatment and at the end of each treatment day. Follow-up measurements and subjective assessments were made at one-month intervals for a total of three months. No additional microcurrent or physical therapy was permitted until the end of the three-month follow-up period.

[0049] The range of right/left cervical rotation was compared to the nominal value of 170 degrees, which is considered normal for a healthy young individual. Ninety-two percent (24/26) of the patients exhibited improved cervical rotation at the end of microcurrent therapy. Of the twenty-two who returned for the three-month follow-up visit, three experienced continued improvement, while seventeen lost some of their range-of-motion, though their average mobility was somewhat better than it had been before microcurrent therapy. One patient in the mildly limited category experienced no improvement and one asymptomatic patient had measurements in the mildly limited category at the three-month follow-up. Referring to FIG. 9, a graph illustrates improvements for the three patients who started with severe limitations and completed all three follow-up visits on schedule.

[0050] Range of cervical extension/flexion was compared to the nominal value of 120 degrees, which is considered normal for a healthy young individual. Eighty-five percent (22/26) of the patients exhibited improved extension/flexion at the end of microcurrent therapy. Of the twenty-two who returned for the three-month follow-up visit, eight maintained or improved their end-of-treatment status. Ten of the twenty-two patients lost some range of motion but their mobility was still better than it had been before microcurrent therapy. The four patients who experienced no long-term improvement were already functioning within 80-90% of normal range. Referring to FIG. 10, a graph illustrates improvements for the three patients initially classified as most severely limited in extension/flexion.

[0051] Range of cervical right/left lateral flexion was compared to the nominal value of 90 degrees, which is considered normal for a healthy young individual. Eighty-one percent (21/26) of the patients exhibited improved range of lateral flexion at the end of microcurrent therapy. Of the twenty-two patients who returned for the three-month follow-up visit eight had continued to improve their range of motion without any additional therapy. Nine patients experienced a decrease compared to their ranges at the end of therapy but their mobility was still better than their measurements before therapy. Five patients experienced no long-term improvement. Referring to FIG. 11, a graph illustrates the improvements for the four patients who started with severe limitations and completed all three follow-up visits on schedule.

[0052] Referring to FIG. 12, a flow diagram sets forth steps that can be taken to apply intra-oral microcurrent therapy to patient suffering from xerostomia. Microcurrent therapy can be provided to a patient within the patient's mouth directly onto gums. A system such as that described in FIG. 5 can be used for delivering microcurrent up to about 200 microamps and at various frequencies (e.g., spiked/sinusoidal pulsed biphasic) in the range of 0.5 Hz to 500 Hz. Current above 200 microamps using a small probe can cause pain to patients because of the current density delivered over a small contact area. It should be appreciated to those skilled in the art that probes or conductive media providing larger contact areas can provide for higher currents, perhaps approaching 600 microamps.

[0053] As shown in block 1602 of FIG. 12, a patient's mouth must first be cleared of foreign matter (e.g., tobacco products, gum,

removable orthodontics, or other medical devices. Then as shown in block 1604, a sinusoidally pulsed biphasic DC signal can be applied to the gum areas in the patient's mouth using at least one electrode. The electrode should preferably be small and smooth enough to be maneuvered comfortably over the gums of the patient. The areas targeted for treatment are just above the patient's upper teeth and just below the patient's lower teeth. As shown in block 1606, the electrode (probe) can be manipulated over the patient's gums for a predetermined time. Generally a 10-20 minute treatment is within a comfortable range for most patients. Finally, as shown in block 1608 the frequency and amplitude of the sinusoidal signal can be adjusted during the course of treatment. Frequency can be varied within a 0.5-500 Hz range, and applied current during treatment can be up to about 200 microamps in most cases.

[0054] Referring to FIG. 13, another flow chart of a method for treating xerostomia is illustrated. As shown in block 1702, a patient's mouth must first be cleared of foreign matter (e.g., tobacco products, gum, removable orthodontics, or other medical devices. Then as shown in block 1704, a spiked pulsed biphasic DC signal can be applied to the gum areas in the patient's mouth using at least one electrode. The electrode should preferably be small and smooth enough to be maneuvered comfortably over the gums of the patient. The areas targeted for treatment are just above the patient's upper teeth and just below the patient's lower teeth. As shown in block 1706, the electrode (probe) can be manipulated over the patient's gums for a predetermined time. Again, generally a 10-20 minute treatment is within a comfortable range for most patients. Finally, as shown in block 1708 the frequency and amplitude of the spiked signal can be adjusted during the course of treatment. Frequency can be varied within a 10-500 Hz range, and applied current during treatment can be up to about 200 microamps in most cases.

[0055] In head-and-neck cancer patients, radiation-induced fibrosis can lead to many different complaints, depending on the size and placement of treatment fields, the total dose, and whether the patient also had surgery. Limitations in neck range-of-motion are common and are quantifiable. Because this study was looking for objectively measured changes associated with microcurrent therapy, the protocol was designed to achieve improvement in range of motion. Measurements were made on all patients in the study regardless of whether the patient considered range-of-motion limitations to be a problem. In fact, most of the patients in the mildly and moderately limited groups had learned to compensate for the limitations and were surprised when measurements showed how much capability they had lost. As could be expected, the patients who were most severely limited received the greatest degree of benefit.

[0056] Patients also received relief from a number of complaints that were not directly targeted in the treatment protocol, the most significant of which were trismus (limited mouth opening) and xerostomia.

[0057] Oral opening was measured using a Therabite.TM. scale (manufactured and supplied by Therabite Corp.) as shown in FIG. 14. The measurement was made for all 26 patients, even if trismus was not a complaint. Eighty-one percent (21/26) of the patients exhibited improved oral opening after impedance-controlled microcurrent therapy. It should be noted that only 16 of the 26 patients stated that trismus was a problem. Four of the sixteen showed no improvement during the course of the study. One had no improvement at the end of the treatment week but had gained 3 mm in oral opening at the end of three months. For the seven patients who maintained improvement in oral opening the average increase was 4.6.+-.2.2 mm three months after the end of microcurrent therapy.

[0058] Sixteen patients with xerostomia were treated using the Electro-Myopulse 75F and Electro-Acuscope 80L, which are commercially available instruments. All patients had received a full course of either photon or neutron radiation as treatment of a malignancy of the head and neck. All were at least six months post radiation therapy and had no evidence of disease. External electrodes were used to administer microcurrent therapy twice per day for five consecutive days. Saliva production was quantified by weighing the saliva each patient was able to expectorate into a paper cup during a five-minute period. Both un-stimulated saliva production (USP) and stimulated saliva production (SSP) rates were obtained, with concentrated lemon juice used as a stimulating agent. Data were collected before the first microcurrent treatment, after ten treatments, and monthly during the three-month follow-up period.

[0059] At the conclusion of five treatment days, 81% of the patients (13/16) experienced an increase in USP. Twelve of these patients also experienced an increase in SSP. The increases in mean USP and SSP rates were 56% and 42%, respectively. During the three-month follow-up period patients received no additional microcurrent therapy. Of the fifteen who returned for follow-up after three months, 11/15 and 12/15 had higher USP and SSP rates, respectively than their pre-microcurrent baseline rates. The improvement for the mean USP was 104%, while the mean SSP was 38% greater than baseline. For some of these patients, (10/15) and (7/15), the USP and SSP rates were higher than their end-of-treatment rates, indicating continued improvement during the follow-up period. No patients experienced any untoward effects.

1TABLE 1 List of subjective complaints. Denominator indicates number of patients reporting a symptom. Numerator is the number who reported an improvement in the symptom after impedance-controlled microcurrent therapy. Percentage reporting Symptom improvement. Tongue immobility 3/8 = 37% Impaired speech 3/6 = 50% Stiffness discomfort 24/26 = 92% Facial asymmetry 6/7 = 86% Soft tissue edema 11/17 = 65% Trismus 10/16 = 62% Dry mouth 15/20 = 75% Difficulty swallowing 4/10 = 40% Cervical/facial spasms 10/12 = 83% Fibrosis 12/20 = 60% Inability to purse lips 5/5 = 100% Difficulty breathing 3/3 = 100% Tenderness 10/15 = 67% Pain 9/13 = 69% Numbness 6/8 = 75%

[0060] Many of the benefits observed at the end of the treatment week were sustained. In some cases there was continued improvement during the three-month follow-up period suggesting that the treatment had initiated tissue repair. These observations support the view that microcurrent therapy can initiate long-term benefit for patients suffering from fibrosis.

Noninvasive detection and activation of the lymphatic system in treating disease and alleviating pain (pgs 129-147) (Using surface electrical stimulation)

United States Patent **6,676,686**
Naganuma **January 13, 2004**

Abstract

A method is provided for treating disease and alleviating pain associated with the lymphatic system in a living mammalian body. The method generally relates to a noninvasive method for alleviating a disorder associated with a portion of the lymphatic system, e.g., a lymph node in a living mammalian body, wherein the treatment involves lymphatic activation characterized by **localized pulsations at the closest exterior body surface to the activated portion of the lymphatic system. The activation involves placing a stimulation source in physical contact with the closest exterior body surface. In addition, an opposing body surface with respect to the closest exterior body surface is contacted simultaneously with the stimulation source.** The stimulation source transfers energy to the affected portion until the localized pulsations substantially subside and/or lymph obstruction is substantially eliminated. This noninvasive method is particularly suited for pain relief and healing.

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Parent Case Text

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No. 60/199,531, filed Apr. 25, 2000.

Claims

I claim:

1. A noninvasive method for alleviating a disorder associated with a lymph node in a living mammalian body, the method comprising:

(a) providing physical contact with a stimulation source simultaneously at the closest exterior body surface to the lymph node and an

opposing body surface with respect to the exterior body surface;

(b) transferring energy from the stimulation source to the closest exterior body surface so as to induce localized pulsations that characterize the activation of the lymph node; and

(c) sensing localized pulsations then ceasing energy transfer when the localized pulsations cease.

2. The method of claim 1, wherein the living mammalian body is not anaesthetized.

3. The method of claim 1, wherein the lymph node is located closer to an artery than a vein.

4. The method of claim 3 wherein the lymph node is located within the rib cage.

5. The method of claim 1, wherein the stimulation source has a substantially constant temperature in the range of about 34.degree. C. to about 40.degree. C.

6. The method of claim 1, further comprising raising the temperature of the closest exterior body surface.

7. The method of claim 6, wherein the temperature of the closest exterior body surface is raised by about 1.degree. C. to about 2.degree. C.

8. The method of claim 1, wherein the physical contact of step (b) is provided to an area of about 1 cm.sup.2 to about 400 cm.sup.2 of the closest exterior body surface.

9. The method of claim 8, wherein the area is about 1 cm.sup.2 to about 250 cm.sup.2.

10. The method of claim 1, wherein the stimulation source comprises a contact surface that is composed of an organic flexible material.

11. The method of 5, wherein the stimulation source is capable of sensing the localized pulsations.

12. The method of claim 1, step (b) comprises transferring a non-thermal energy to the closest exterior body surface.

13. The method of claim 12, wherein the non-thermal energy is magnetic.

14. The method of claim 13, wherein the non-thermal energy is ***electrical***.

15. The method of claim 1, wherein the living mammalian body is human.

16. The method of claim 1, wherein the living mammalian body exhibits edema.

17. The method of claim 16, wherein the edema is lymphedema.

18. The method of claim 1, wherein the living mammalian body exhibits ***cancer***.

19. The method of claim 1, wherein the living mammalian body has undergone treatment for ***cancer***.

20. The method of claim 19, wherein the treatment for ***cancer*** comprises radiation therapy, chemotherapy or surgery.

21. The method of claim 1, wherein the living mammalian body exhibits an autoimmune disease.

22. The method of claim 21, where the autoimmune disease is rheumatoid arthritis.

23. The method of claim 1, wherein the living mammalian body is obese.

24. The method of claim 4, wherein the source is an individual.

25. The method of claim 24, wherein the individual is human.

26. The method of claim 25, wherein step (a) comprises establishing static physical contact between the closest exterior body surface and a fingertip of the individual.

27. The method of claim 25, wherein step (a) comprises establishing contact between the opposing body surface and a hand of the individual.

28. The method of claim wherein step (a) comprises establishing physical contact between the closest exterior body surface and a fingertip of the individual.

29. The method of claim 25, wherein the localized pulsations are detectable through tactile sensations.

30. The method of claim 25 wherein the localized pulsations are detectable by the individual as a sound.

31. The method of claim 30 wherein the sound characterizes decongestion of a portion of the lymphatic system.

32. The method of claim 30, wherein the sound characterizes improved blood flow.

33. The method of claim 30, wherein the sound characterizes improved lymph flow.

34. A noninvasive method for draining a portion of a lymphatic system in a living mammalian body, the method comprising:

(a) providing physical contact with a stimulation source simultaneously at an exterior body surface that exhibits a symptom due to blockage of the portion of the lymphatic system and at an opposing body surface with respect to the exterior body surface;

(b) transferring energy from the stimulation source to the exterior body surface to induce localized pulsations that characterize lymphatic activation and drainage; and

(c) sensing localized pulsations then ceasing energy transfer when the localized pulsations cease.

35. The method of claim 34 wherein the energy is magnetic, thermal or ***electrical*** energy.

36. A noninvasive method for alleviating discomfort associated with a malfunctioning portion of a lymphatic system in a living mammalian body, the method comprising:

(a) providing physical contact with a stimulation source simultaneously at the closest exterior body surface to a malfunctioning portion of the lymphatic system and at an opposing body surface with respect to the exterior body surface;

(b) transferring energy from the stimulation source to the closest exterior body surface to induce localized pulsations that characterize the activation and drainage of the malfunctioning portion of the lymphatic system; and

(c) sensing localized pulsations then ceasing energy transfer when the localized pulsations case.

37. The method of claim 36, wherein steps (a) and (b) are repeated.

38. The method of claim 37, wherein steps (a) and (b) are regularly repeated.

39. The method of claim 36, wherein the discomfort is painful.

40. A noninvasive method for detecting a malfunctioning portion of the lymphatic system in a living mammalian body, the method

comprising:

(a) providing physical contact between a stimulation source and an exterior body surface;

(b) transferring energy from the stimulation source to the exterior body surface; and

(c) detecting pulsations in response to the transfer of energy.

Description

TECHNICAL FIELD

The present invention relates to a method for treating disease and alleviating pain associated with the lymphatic system in a living mammalian body. More particularly, the present invention relates to a noninvasive method for detecting and activating the lymphatic system wherein the method involves the generation of a pulsation detectable at the closest exterior body surface to an activated lymphatic area.

BACKGROUND

The lymphatic system is a subsidiary of the circulatory system that offers a route for the return of tissue fluid to the bloodstream. The system includes lymph capillaries that begin in tissue to collect tissue fluid, i.e., lymph. The capillaries eventually lead into lymphatic vessels which empty lymph into large veins above the heart. Along the pathway of the lymphatic vessels are specialized structures called lymph nodes. The lymph nodes serve two important purposes--as a filter to prevent the spread of infection and as a source of lymphocytes. In contrast to the cardiovascular system which forms a complete circuit, the lymphatic system is a one-way system.

Lymphatic capillaries are simple endothelial tubes that form a complex network in tissues. Beginning blindly, the capillaries may vary greatly in size ranging from a diameter of about a few microns to about a millimeter. Ordinarily, these capillaries do not contain valves. The network of capillaries is most dense in surface layers of the body, such as in the dermis of the skin and the mucosal layers of the digestive and respiratory system. Muscles and bones, for example, exhibit a lower density of lymphatic capillaries while no lymphatic capillaries are found in the central nervous system, meninges, epidermis, and eyeball. A special category of lymphatic capillaries extends as blind ends into the intestinal villi and are known as lacteals. Lacteals are connected to the thymus. During fat absorption from the intestine, the lymph within lacteals becomes milky in appearance and is called chyle.

The lymphatic capillaries convey lymph to larger lymph vessels (lymphatics) which resemble veins in structure but have thinner walls and more valves. The lymphatics also contain a large number of lymph nodes, usually about 600, at various intervals throughout the body. They are disposed in loose connective tissue between organs, the subcutaneous and subserous tissues, and in the submucosa of

the digestive, respiratory, and urogenital tracts. Shallow lymphatics of the skin generally follow veins, while deeper lymphatics generally follow arteries. The lymphatics serve to deliver lymph throughout the body and return proteins to the cardiovascular system when they leak out of blood capillaries. Lymphatics also transport fats from the gastrointestinal tract to the blood. Lymph flow is effected by the milking action of the muscle tissues of the body on the adjacent or contained lymphatic capillaries and vessels. Valves insure that lymph is conveyed in the correct direction.

Lymphatic nodes are typically bean-shaped collections of lymphatic tissue interposed in the course of lymphatic vessels. The tissue of the node is enclosed in a strong fibroelastic capsule. Trabeculae originate from the capsule and into the node to divide the node into several compartments. A network of reticular fibers with reticulo-endothelial cells extends from the trabeculae to all parts of the node. The cortex, i.e., the outer part of the node, contains closely packed masses of lymphocytes and lymph follicles. Several afferent lymphatic vessels enter the node on its convex surface and release lymph into the sinuses of the node. As the lymph slowly moves through the node, reticulo-endothelial cells filter out foreign particles such as bacteria via phagocytosis. As a result, foreign particles are prevented from entering the bloodstream. In addition, lymphocytes produced in the germinal centers of the lymph follicles are introduced into the lymph stream. Efferent lymphatic vessels at the node's hilum located on the nodes' concave surface allow lymph to leave the node to continue toward the venous system. Valves disposed in the afferent and efferent lymphatic vessels insure proper lymph flow direction. Blood vessels interface with the node at the hilum.

In sum, lymph nodes provide a key component for the proper immunological function of mammals. In humans, lymph nodes can be found in a high concentration in the face and neck, the arm pits, the thoracic cavity, the intestines and groin, the elbows, and the knees. Many different types of lymphocytes are produced by these nodes in the human body. Some lymphocytes (T cells) destroy infectious agents directly or indirectly by releasing various substances. Other lymphocytes (B cells) differentiate into plasma cells that secrete antibodies against foreign substances to help eliminate them. The spleen, thymus and tonsils are the lymphatic organs which produce B-cells, T-cells, and lymphocytes, respectively, and, with antibodies, complete the lymphatic system immunologic defenses. Importantly for ***cancer*** patients, lymphatic tissue functions in surveillance and defense against foreign cells, microbes, and ***cancer*** cells and other pathogens, as is discussed infra.

A compromised lymphatic system is associated with disease and pain as many lymph nodes and other components of the lymphatic system are located at or near nerve endings. Lymphedema, for example, is a disorder of the lymphatic system wherein excess lymph is accumulated. Such undesirable accumulation causes swelling in different part throughout the entire body including, but not limited to, the arm(s) and/or leg(s). Generally, lymphedema can develop when lymph vessels are missing or impaired, when lymph vessels are damaged, or when lymph nodes are removed. In essence, lymphedema results when the amount of lymph exceeds local lymphatic transport capacity and an abnormal amount of protein-rich fluid collects in the tissues of the effected area. It is important to emphasize that if left untreated, this stagnant protein-rich fluid causes tissue channels to increase in size and number, reduces oxygen availability in the transport system, interferes with wound healing, and provides a medium in which bacteria can incubate and proliferate, resulting in lymphangitis. The reduction of oxygen will cause lymph nodes to restrict the flow resulting from lymphatic drainage. Moreover, such swelling may cause or aggravate hernias.

In addition, ***cancer*** is often associated with lymphedema. Many ***cancer*** patients undergo surgery or radiation therapy to eliminate the cancerous growth. Surgery may remove lymph nodes, particularly if cancerous cells are identified in the lymph nodes, and lymphedema may occur as a result. In addition, radiation therapy will lead to an edema of irradiated soft tissues and lymphedema of any irradiated lymphatic tissue. Lymphedema is generally the more serious of these two side effects, because of the importance of the patient's lymphatic system to continued immune function and general health. However, repetition of radiation therapy can both further and prolong lymphedema, frequently making it a progressively more severe side effect. In addition, chemotherapy following surgery may also worsen lymphedema if administered to an already affected area.

Symptomatically, edema and lymphedema may be particularly pronounced in the upper torso due to radiation treatment of cancers of the head and neck, lungs, breast and the lymphatic system. Strong and frequent upper body radiation may cause fibrosis of the jaw and neck with excessive fibroblast deposition, thus virtually immobilizing patients and requiring such patients to be fed with a straw. Fibrosis of the upper arm may also occur with continuing radiation treatment thereby limiting the range of motion for the affected limb(s). In addition, new tumors may emerge in the edematous limbs and other portions of the lymphatic system because tumor cells, given the reduced lymph flows, lymphocyte production and ion exchange in these radiation-induced immunologically compromised edematous body parts, may take root and grow.

Lymphedema is treated through a variety of regimens with varying degrees of success. Such regimens often involve compression therapy or mechanical action. For example, U.S. Pat. No. 5,672,148 to Maunier describes a hydraulic device for lymphatic drainage and massage of the human body. This reference is directed to a device that can transmit a large variety of pressure ranges over any portion of the body with pressure profiles adapted to effect desired lymphatic drainage. It may be possible to improve lymphatic circulation, as described in U.S. Pat. No. 5,940,888 to Sher, by wearing a lymphatic circulation enhancer attached under the side panels of a woman's brassier. The enhancer comprises a lattice framework having a plurality of raised protuberances projecting outward therefrom. Such lymphatic circulation enhancers are described to provide relief from constriction of the lymph system by a woman's bra. Such devices suffer from the limitation that non-surface portions of the lymphatic system, e.g., the portion within the rib cage, are unaffected through device use.

Pharmacologically active agents may also effect lymph node drainage or activity. For example, U.S. Pat. No. 5,753,237 to Daynes et al. describes a method of augmenting immunological responses by administering a vaccine comprising an immunizing agent and a vaccine adjuvant of dihydroepiandrosterone sulfate (DHEAS) or 16.alpha.-bromo-DHEAS. It is described that such administration of the adjuvant and the immunizing agent may drain a lymph node. In addition, U.S. Pat. No. 5,595,743 to Wu describes a process for preparing an herbal medicine. The process involves forming a mass from raw material, finely grinding the mass to make average size of suspended particles less than 50 .mu.m, hydrolyzing the ground material by using a particular multi-enzyme system, and sterilizing the hydrolyzed material. By using poria, pinellia tube, pilose asiabell root, immature bitter orange, green tangerine orange peel, atrac tylodes rhizome, fresh ginger, oldenlandia and loniccera japonica flow in a proper proportion as raw material, the herbal medicine produced by this method is described by Wu as capable of inhibiting edema and improving cell activity of T lymphocyte cell.

Lymphedema may also be treated by application of an interferential ***microcurrent electrical*** waves. For example, U.S. Pat. No. 5,817,138 to Suzuki describes a method for treating a patient having lymphedema to improve lymphatic flow. The method involves providing multiple pairs of electrodes, each pair of electrodes connected to an ***electrical*** source defining a channel to provide a micro current of electricity across patient tissue, and positioning four or more pairs of electrodes on the patient, each electrode proximal to a center of lymph nodes. Then, a controlled current from about 20 .mu.A to about 200 .mu.A is provided to each channel at a frequency of up to 300 Hz. In addition, a first frequency is provided to at a first channel and a second frequency is provided to another channel to create an interferential wave form. Finally, pulsed ***electrical*** currents are passed through the patient's body using a wave form envelope with a mandatory pause between pulses. This reference also describes incorporation of the electrodes in gloves such that massaging movement may be applied during application of the micro currents.

Beside lymphedema, the lymphatic system is associated with autoimmune diseases such as rheumatoid arthritis (RA). In RA, as with other autoimmune diseases, a patient becomes immunologically sensitive to an antigenic material in his or her own body. The primary symptom of RA is inflammation of the synovial membrane, wherein the membrane thickens and synovial fluid accumulates. The resulting pressure causes pain and tenderness. As lymphocytes and macrophages learn to react to these unknown "self-antigens," they accumulate in the target organ, i.e., the synovial tissue, a hydrated sack which functions as a cushion and a lubricated bearing between the joints of the skeleton. The macrophages release small amounts of nitrous acid. Together with released free radicals and nitrosylated tyrosine residues of various proteins and polypeptides, these materials are strongly cytotoxic and produce a pannus of necrosis within the synovium, which adheres to the articular cartilage. Pannus formation sometimes erodes the cartilage completely. When the cartilage is destroyed, fibrous tissue joins the exposed bone ends. The tissue then ossifies and fuses the joint so that it is immovable, leading to a failure of the targeted joint, thereby crippling the patient in use of the afflicted limb. It is described that such arthritis may be treated by injecting a preparation comprising a pressure treated autoimmune specific T cell composition. See U.S. Pat. No. 4,996,1984 to Cohen et al. Such a composition may be prepared using T lymphocyte mitogen activated lymph node cells.

The lymphatic system has also been linked with obesity control. U.S. Pat. No. 5,391,143 to Kensey describes an implantable system for effective removal of fat or other components carried by the lymphatic system from a body by draining some lymphatic fluid from the body. The reference describes that the system may remove fat continually over a protracted period of time from the lymphatic fluid.

It is evident that current methods for effecting healing that involve the lymphatic system require mechanical action, interferential ***electrical*** microcurrents, pharmacologically active agents, and/or invasive procedures. Thus, there is a need to provide a new noninvasive method to treat conditions resulting from lymphatic disorders.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to overcome the above-mentioned disadvantages of the prior art by providing a

new method that noninvasively detects and activates the lymphatic system in treating disease and alleviating pain without side or after effects that characterize many other lymphatic treatments.

It is another object of the invention to provide a method to drain a portion of a lymphatic system of a living mammalian body to promote proper functioning of immunological response to pathogens.

Additional objects, advantages and novel features of the invention will be set forth in part in the description which follows, and in part will become apparent to those skilled in the art upon examination of the following, or may be learned by practice of the invention.

In one aspect, then, the present invention generally relates a non-invasive method for alleviating a disorder associated with a lymph node in a living mammalian body. The method calls for physical contact with a stimulation source to be provided simultaneously at the closest exterior body surface to the lymph node and at an opposing body surface. Once in place, the stimulation source transfers energy to the closest exterior body surface so as to induce localized pulsations that characterize the activation of the lymph node. In certain instances, the energy transfer stimulates a diseased lymph node. For optimal results, energy is continuously transferred until the localized pulsations substantially subside. This non-invasive method is particularly suited for use without anesthesia and applicable to a non-surface lymph node, i.e., one that is located is closer to an artery than a vein.

In another aspect, the invention relates to the method as above, wherein the stimulation source has a substantially constant temperature in a range from about 30.degree. C. to about 45.degree. C. and contacting the closest exterior body surface with the source. In addition, the simulation may cause the simulated area to increase in temperature.

In still another aspect, the invention relates to the method as above, wherein the closest exterior body surface contacts a source surface adapted to conform to the closest exterior body surface. In addition, the opposing body surface may also contact another source surface adapted to conform to the opposing body surface. The source surface may comprise a flexible and/or organic flexible material.

In a further aspect, the invention relates to the method as above, wherein contact is provided at a time to an area of about 1 cm.sup.2 to about 400 cm.sup.2 of the closest exterior body surface.

In a still further aspect, the invention relates to the method as above wherein non-thermal energy is transferred to the closest exterior body surface. The non-thermal energy may be ***electrical*** or magnetic.

In another aspect, the invention relates to the method as above, wherein the living mammalian body having the disorder is human. The living mammalian body may exhibit edema such as lymphedema, ***cancer,*** auto-immune diseases such rheumatoid arthritis or obesity. In addition, the living mammalian body may have undergone other treatment for ***cancer*** such as radiation therapy, chemotherapy or surgery.

In still another aspect, the invention relates to the method as above, wherein the stimulation source is the hand or other body part of a human individual. Preferably, the individual establishes physical contact between the closest exterior body surface and his or her hand or fingertip. In addition, contact may be established between the opposing body surface and the other hand of the individual. Preferably, the individual can detect the localized pulsations through tactile sensations and/or as sounds.

In a further aspect, the invention generally relates to a noninvasive method for draining a portion of a lymphatic system in a living mammalian body. The method involves providing physical contact with a stimulation source simultaneously at an exterior body surface that exhibits a symptom due to blockage of the portion of the lymphatic system and at an opposing body surface with respect to the exterior body surface. Once contact is established, energy is transferred from the stimulation source to the exterior body surface to induce localized pulsations that characterize lymphatic activation and drainage. The energy may be magnetic, ***electrical,*** possibly thermal or some other type of energy. Energy is transferred to the closest exterior body surface until lymphatic healing is complete.

In a still further aspect, the invention generally relates to a noninvasive method for alleviating discomfort such a pain associated with a malfunctioning portion of a lymphatic system in a living mammalian body. The method involves providing physical contact with a stimulation source simultaneously at the closest exterior body surface to a healthy portion of the lymphatic system and at an opposing body surface with respect to the exterior body surface. Once such contact is established, energy is transferred from the stimulation source to the closest exterior body surface to induce localized pulsations that characterize the activation and drainage of the malfunctioning portion of the lymphatic system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A-1C, collectively referred to as FIG. 1, are graphical representations of digitized sound recordings of pulsations associated with a diseased lacteal lymph node recorded before, during and after treatment, respectively.

FIGS. 2A-2C, collectively referred to as FIG. 2, are graphical representations of digitized sound recordings of pulsations associated with diseased lymph nodes near the thymus recorded before, during and after treatment, respectively.

DETAILED DESCRIPTION OF THE INVENTION

Before describing the invention in detail, it must be noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a lymph node" includes more than one lymph node, reference to "a stimulation source surface" includes a plurality of stimulation source surfaces and the like.

In describing and claiming the present invention, the following terminology will be used in accordance with the definitions set out below.

The term "activate" as used herein refers to the inducing of a portion of the lymphatic system to engage in activity that characterizes healthy functioning of that portion. For example, activating a lymph node involves inducing the lymph node to produce lymphocytes and effect filtration of lymph, and activating a portion of the lymphatic system having valves involves opening valves along the lymphatics to effect proper lymph flow. Activation is typically accompanied by localized pulsations.

The term "localized pulsations" is used herein to refer to a substantially rhythmic throbbing or vibration in a mammalian body, wherein the substantially rhythmic throbbing is detectable near the source of the pulsation. Depending on the intensity at the source of the pulsation, localized pulsations are typically detectable only at a portion of the body surface near the source of the pulsation, i.e., a malfunctioning portion of the lymphatic system, typically a lymph node. Without invasive means, the localized pulsations are typically most easily detected at the closest exterior body surface to the source of the pulsation and sometimes, to a lesser degree, at the opposing body surface with respect to the closest exterior body surface.

The term "obese" as used herein refers to a state of a mammalian body in which the ratio of fat to lean body mass is at least about 20 percent higher than the accepted norm for healthy functioning of the body.

The term "opposing body surface with respect to the closest exterior body surface" as used herein refers to the location on the body surface that intersects a line extending through both the interior of the body affected by a lymphatic disorder and the closest exterior body surface thereto.

The term "physical contact" as used herein refers to the contact between two bodies such that the surfaces of the bodies are substantially immobile with respect to each other. In other words, the surfaces of the bodies may exhibit only slight movement with respect to each other. In addition, pressure between the contacting surfaces is maintained at a substantially constant level. Ordinary massage techniques, acupressure, and other forms of motion is neither desirable nor required for physical contact.

The term "stimulation source" as used herein refers to a body that is capable of conducting energy to another body surface. Energy from the stimulation source may be ***electrical,*** magnetic, thermal or of a yet unidentified character that, when applied to an affected portion of the lymphatic system, promotes lymphatic activation and healing that is characterized by localized pulsations.

It is known that many mammalian ailments are associated with the lymphatic system and, in particular, with a lymph node within the body. Examples of these disorders include, but are not limited to, arthritis, ***cancer,*** obesity, and lymphedema. These disorders are conventionally treated by various regimens. For example, treatments for ***cancer*** include various forms of surgery, chemotherapy, and radiation therapy. Obesity can be treated, e.g., through restricting calorie intake, increasing physical activity and liposuction. Many of these ailments are associated with a disorder of the lymphatic system, wherein the disorder is associated with a lymph node in the mammalian body or with a portion of the lymphatic system in need of drainage. Notably, it has now been discovered that many of these disorders are associated with a lymph node or a portion of the lymphatic system that may be activated or drained through energy

transfer that promotes healing as evidenced by pulsations in response to the transferred energy. These pulsations form a basis of the invention which allows noninvasive detection and activation of the lymphatic system in treating disease and alleviating pain.

One aspect of the invention involves a non-invasive method for alleviating a disorder associated with a lymph node in a living mammalian body. In order to provide relief to a lymph node disorder, it is often important to detect the malfunctioning or inactive lymph node associated with the disorder. Detection can be accomplished in a number of ways depending on the symptoms of the disorder. For example, lymphedema, as describe above, results when the amount of lymph in a portion of the lymphatic system exceeds its lymphatic transport capacity and an abnormal amount of protein-rich fluid collects in the tissues of the effected area. As a result, swelling occurs in the effected area. The swelling may provide a generalized indication of the location of one or more diseased, damaged or inactive lymph nodes. Swelling may develop in three stages, ranging from mild to severe. Stage 1 lymphedema exhibits the mildest form of swelling that is spontaneously reversible. The affected tissue is still at the "pitting" stage, which means that when pressure is applied by fingertips, the area indents and holds the indentation. Stage 2 lymphedema exhibits spontaneously irreversible swelling in which affected tissue has a spongy consistency and is non-pitting. When pressed by fingertips, the tissue bounces back without any indentation forming. Stage 2 lymphedema may mark the beginning of the hardening of affected tissue through fibrosis leading to stage 3 lymphedema, commonly referred to as lymphostatic elephantiasis. Stage 3 is the most severe form of lymphedema and is characterized by extreme irreversible swelling, particularly when limbs are affected. Affected tissue is hard, fibrotic, and unresponsive fingertip pressure. The severity of swelling in stages may also provide insight into the severity of lymph node disorder.

In addition to detecting swelling through visual or tactile inspection as described above, lymphedema and associated diseased lymph nodes can be detected by evaluation of other symptoms. When lymphedema remains untreated, accumulated protein--rich fluid provides an ideal culture medium for bacteria or other sources of infection leading to lymphangitis. Symptoms of lymphangitis may include some or all of the following: rash; red blotchy skin; itching of the effected area; discoloration; increase of swelling and/or temperature of the skin; an unusually heavy sensation of the affected area; pain; and sudden onset of high fevers or chills. Because infection tends to indicate prolonged and untreated lymphedema, such areas of infection may allow detection of severely diseased lymph nodes.

When external indications of diseased lymph nodes are not readily apparent or when more specific information relating to a lymph node is needed, more sophisticated methods of detection may be used. One such method of detection is described in U.S. Pat. No. 4,827,945 to Groman et al. This patent describes the use of superparamagnetic metal oxide materials exhibiting certain magnetic and biological properties which make them uniquely suitable for use as magnetic resonance imaging (MRI) agents to enhance MRI images of human organs and tissues. These agents may be coated with biological molecules to target specific organs or tissues such that, upon administration to an animal, the agents are collected in the target organs. The MRI agents are administered by various routes but are typically injected directly into the animal's bloodstream.

In addition, radiation-based methods for locating lymph nodes are known. For example, U.S. Pat. No. 5,732,704 to Thurston et al. describes a method for identifying a sentinel node located within a grouping of regional nodes at a lymph drainage basin associated

with neoplastic tissue such as those found in cancerous tumors. The sentinel node is the nearest lymph node to the site of the neoplastic tissue and within the pertinent lymph drainage basin. Such a node, being on the most direct drainage pathway, will present the most likely site of early metastasis. The method, like other radiation-based detection methods, requires a radiopharmaceutical to be injected at the situs of the neoplastic tissue. This radiopharmaceutical migrates along a lymph duct toward the drainage basin containing the sentinel node. The sentinel node is located where detected radiation intensity is at a local maximum. U.S. Pat. No. 5,961,458 to Carroll describes a minimally invasive surgical probe for detecting and removing radioactively tagged tissue, e.g., a sentinel lymph node within the body of a living being.

The present invention in one aspect requires that a stimulation source be placed in physical contact with the closest exterior body surface lymphatic tissue affected by the disorder. In order to determine the closest exterior body surface, any of the above methods can be used, e.g., monitoring external swelling, detecting temperature change, assessing level of pain, or tagging affected lymphatic tissue with radiopharmaceuticals or magnetic media. However, none of these methods is an ideal substitute for detecting pulsations that occur only when a malfunctioning portion of the lymphatic responses to energy transfer from a stimulation source as described below. In other words, external swelling is not necessarily an indication of a lymphatic disorder characterized by localized pulsations. To detect such pulsations by touch, one of typically places a hand on the external surface of the affected body. The hand, usually the palm side, is slid across the surface to sense the area on which the pulsations are most strongly detected. Fingertips are particularly sensitive to such pulsations. Touch may involve direct skin to skin contact or contact through clothing or other materials.

Sometimes, when the disorder is severe, the pulsation can also be detected as sound, in which case physical contact is helpful to locate the precise location where the pulsations are strongest. Alternatively, a sound detector may be employed. Such sounds may be recorded by employing a microphone at or near the area of treatment, before, during or after treatment. Graphical representations of digitized sound recordings of pulsations associated with a diseased lymph node recorded before, during and after the application of the simulation source to the affected area are shown in FIGS. 1 and 2. The ordinate axes of the figures represent time and the abscissa axes of the figures represent the amplitude of recorded sound. The sound recordings were made through the use of a contact microphone substantially immobilized with respect to exterior surfaces of a female human subject near a dysfunctional lymph node. Such contact microphones are well known in the art and are commercially available from a number of manufacturers and vendors. These figures are representative of sounds recorded from individuals receiving treatment according to the method of the invention, on an on-going basis. Pulsation intensity is strongly correlated with the amplitude of the recorded sound.

It is evident from FIGS. 1 and 2 that there are significant differences between the pulsations recorded before, during and after treatment. As shown in FIGS. 1A and 1B, pulsations recorded before treatment exhibit an overall greater amplitude than pulsations recorded during treatment. In addition, as shown in FIGS. 1B and 1C, pulsations recorded during treatment exhibit an overall greater amplitude than pulsations recorded after treatment. In other words, attenuation of the pulsations associated with a lymph node disorder is achieved through the practice of the inventive method. Further, FIG. 1 indicates that treatment employing the inventive method results in pulsations having a greater regularity in frequency and amplitude than the pulsations recorded before treatment. As the pulsations are reduced during treatment, it is evident that the localized pulsations indicative of a lymphatic disorder are more irregular

than pulsations present in a healthy body and associated with ordinary vital functions such as breathing and blood flow.

Similarly, FIG. 2 further illustrates that the present treatment method tends to result in the attenuation of pulsations. FIGS. 2A and 2B illustrate that the inventive method results in pulsation attenuation during treatment. While FIGS. 2B and 2C, when viewed together, show that there may be some recovery in amplitude of the pulsations when the treatment is stopped, it is clear that the amplitude of the pulsations after treatment, as illustrated in FIG. 2C, is lower than the amplitude of the pulsations before treatment, as illustrated in FIG. 2A. That is, overall reduction of pulsation amplitude is not limited to the duration of treatment. Typically, patients undergoing continuing treatment tend to respond more readily to the inventive treatment than those who receive treatment occasionally.

In addition, the pulsations may be detected as a palpitation. When the pulsations are present, such pulsations are recognizable by trained human touch. One who is able to detect such pulsations may train another by example, e.g., identifying individuals who suffer from the lymphatic disorder, detecting the localized pulsations, allowing the trainee to touch the affected area on the individual to feel the localized pulsations, and comparing the tactile sensation to an unaffected area or the corresponding area on an unaffected individual. Success from such training may vary with the skill of the teacher and the natural abilities of the student. In rare cases, an individual may be able to detect such pulsations without training from another. One such individual is Ms. Harumi Naganuma of San Francisco, Calif., the inventor herein, but there may be others yet to be identified who can detect such pulsations without training. It is envisioned that such pulsations may be detectable by a device yet to be built.

Once the affected lymphatic region is located, through conventional methods or by detecting pulsations, treatment of the disorder may then take place. Depending on the disorder, treatment by conventional methods may vary. For example, lymphedema can be treated through complex decongestive therapy (CDT) methods. CDT methods involve manual lymph drainage (MLD), compression therapy, remedial exercises and skin care. MLD is a manual treatment technique which improves the activity of lymph vessels by mild mechanical stretches on the wall of lymphatics and nodes where excess lymph is collected. MLD redirects the lymph flow around the blocked areas into other lymphatics that eventually drain into the venous system. Compression therapy increases pressure to affected issue and is applied between MLD treatments to prevent localized reaccumulation of lymph. Compression therapy may be performed in two phases. In the first phase, short stretch bandages are applied, and the second phase, custom-made garments are worn. When the compression bandages and garments are worn, decongestive exercises may be performed as well as respiratory therapy. These exercises assist in bringing about lymphokinetic effects of joint and muscle pumps. Finally, since infections are very common and serious complications of lymphedema, meticulous care must be taken to ensure proper skin and nail hygiene. CDT cannot be undertaken unless there is no sign of lymphangitis. It is evident, then, that CDT is directed to lymphatic drainage at the body surfaces, since activity such as MLD and compression therapy cannot affect lymph nodes located deep within the interior of a body, e.g., closer to an artery than a vein or located within the rib cage.

In addition, treatment for lymphatic disorders may involve removal of lymph fluids from the mammalian body by using catheters such as those described in U.S. Pat. No. 4,957,484 to Murfeldt. This reference describes a device for accessing a thoracic duct or right lymphatic duct to withdraw lymph therefrom. In addition, obesity control may also be effected by removing a fat-like material from

the lymphatic fluid continually over a protracted period of time through an implantable system. See Kensey et al. It is apparent that such drainage techniques involve invasive procedures that require tissue perforation.

In contrast, the invention does not involve invasive procedures but nevertheless brings about drainage and healing of lymph nodes that are positioned deep within the body. A stimulation source, is placed in physical contact with closest surface to the affected portion. Simultaneously, the stimulation source is contacted with the opposing body surface with respect to the closest exterior body surface. As a result, energy from the stimulation source is transferred to the closest exterior body surface. Energy may also be transferred to the opposing body surface as well. Transferred energy is believed to be magnetic, but may in certain instances involve another form of energy by itself or in combination with thermal energy, infrared energy, magnetic energy ***electrical*** energy or another yet to be identified form of energy that promotes lymphatic healing. Beside inducing pulsations in the affected area, energy transfer result in generation of heat by the affected area. Typically, the temperature of the closest exterior body surface to the lymph node is raised. Preferably the temperature of the closest exterior body surface is raised by at least 1.degree. C. Optimally, the temperature of the closes exterior body surface is raised by about 1.degree. C. to about 2.degree. C. Moreover, it is believed that for enhanced performance, the stimulation source may have a substantially constant temperature in a range of about 30.degree. C. to about 45.degree. C., more preferably about 30.degree. C. to about 40.degree. C. Optimally, the substantially constant temperature is about 35.degree. C. to about 37.degree. C. The transfer of energy is typically a mild process that requires continuous contact for a significant amount of time depending on the severity of the disorder.

For mild lymphatic disorders, required contact time may range from about a few minutes to about an hour. Effective treatment for severe lymphatic disorders may require physical contact over at least an hour, and in certain instances, several hours. During contact and energy transfer, a portion of the lymphatic system, typically the lymph node, is activated and drained. Multiple sessions of treatment through an extended period of time may be necessary in extremely severe cases. For example, a patient may require a series of weekly, biweekly or monthly treatment session each lasting from about one to several hours for a case severe lymphatic disorder. The entire series of treatment may take place within a time span of weeks to years, depending on the severity of the disorder.

As the method of the invention brings about drainage and healing of lymph nodes, it is believed that the inventive method may contribute to the elimination of damaged and/or diseased cells. Such damaged and/or diseased cells or portions thereof are conveyed into the lymphatic system and ultimately eliminated as waste from a mammalian body. While not wishing to be bound by theory, it is believed that the inventive method allows the transferred energy to stimulate the mitochondria of nearby healthy cells to efficiently and effectively engage in producing and regulating energy, thereby maintaining the overall well-being of such cells. During this process, DNA in the nuclei of healthy cells "divides" and replicates, forming additional healthy cells. Such division is often accompanied with cell growth to displace the damaged and/or diseased cells that are eliminated through the lymphatic system.

In addition, the stimulation source may have a surface adapted to conform to the contours of bodies affected with a lymphatic disorder. Generally, physical contact is established with the closest surface to the affected region, wherein the contact area occupies about 1 cm.sup.2 to about 400 cm.sup.2. More typically, the contact area covers about 1 cm.sup.2 to about 250 cm.sup.2. Such a

surface may be flexible or elastic, like a human finger. Importantly, the pressure associated with contact ideally should not cause substantial blanching of the tissue near the area of contact. By "blanching" it is meant that body fluid such as blood or lymph is occluded from a region of tissue such that the region is drained of color and appears white. Thus, surfaces with a hard and sharp protrusion may not be suitable for contact with the body. The protrusion may cause localized tissue blanching. When the energy transfer is effected by one more human fingers, it is generally preferable that contact with the effected body is established with the palm side of the fingers when area of body being contacted is convex. The palm side of the human hand is generally more easily adaptable for conformal contact with a convex surface. The back side of the human hand, however, may be more adaptable for conformal contact with some concave surfaces. Both surfaces of the hand may be used simultaneously in some instances. Fingertips are optimal for contact in most instances.

From the above discussion, it is evident that the invention relates to a non-invasive method for alleviating a disorder associated with a portion of the lymphatic system such as a lymph node in a living mammalian body, wherein contact is established with the living mammalian body such that energy is transferred to the body. The method may be used to treat conditions from which mammals, e.g., humans, dogs, cats, horses, cattle, etc., may suffer. Such conditions include, but are not limited to, edemas such as lymphedema, deleterious effects resulting from treatment from ***cancer*** such as radiation therapy, chemotherapy, or surgery, auto-immune diseases such as rheumatoid and other types of arthritis, and obesity. More specifically, diseases that have been treated using the present inventive process that have resulted in partial or near complete healing include, but are not limited to, cataract, glaucoma, fundus hemorrhage, retinal detachment, amblyopia, facial palsy, otitis, tonsillitis, vertigo, sonitus, rhinitis, allergic rhinitis, taste disorder, laryngeal ***cancer,*** alopecia, eczema, urticaria, herpes zoster, herpes simplex, atopic dermatitis, vascular dementia, senile dementia of Alzheimer type, schizophrenia, depression, neurosis, autonomic imbalance, neurosis, insomnia, tonsillitis, glomerular nephritis, constipation, irregular electroencephalogram, atopy, high fever, common cold, influenza, headache, Parkinson's disease, pollinosis, bronchitis, bronchial asthma, pneumonia, pulmonary emphysema, lung ***cancer,*** gastritis, gastritis ulcer, duodenal ulcer, gastric ***cancer,*** large intestine polyp, hepatitis (acute or otherwise), liver ***cancer,*** liver cirrhosis, gall stone, pancreatitis, pancreas ***cancer,*** esophagus ***cancer,*** leukemia, anemia, lymphoma (malignant or otherwise), immunologic deficiency syndrome, thrombocytopenia, angina pectoris, myocardial infarction, heart failure, hypertension, arteriosclerosis, varix, varicosity, sciatic neuritis, intercostal neuralgia, nephritis, renal failure, osteoporosis, diabetes mellirus, thyroid adenoma, nephritis, lung ***cancer,*** high blood pressure, arrhythmia, gastric ulcer, duodenal ulcer, gastric ***cancer,*** intestinal polyp, large intestine ***cancer,*** cholecystitis, gallbladder ***cancer,*** pancreatic ***cancer,*** diarrhea, constipation, hernia, cerebral hemorrhage, cerebral infarction, brain tumor, brain ischemia, hydrocephaly, fracture, dislocation, sprain, tennis elbow, baseball elbow, cervical spondylosis, frozen shoulder, osteoporosis, herniation of the intervertebral disc, lumbago, lower back pain, sciatic neuritis, intercostal neuralgia, stiff shoulders, muscular pain, muscle fragmentation, shrunken Achilles tendon, sprained finger, gout, whiplash cervical injury, transformation of bone, uterine myoma, uterus ***cancer,*** amenorrhea, mastitis, breast ***cancer,*** periodontitis, pulpitis, dental caries, stomatitis, test disorder, abnormal bite occlusion, urethral stone, cystitis, prostate ***cancer,*** urethritis, and nocturnal enuresis.

In addition, it is apparent that contact with such a living mammalian body may be provided with a human individual, specifically, with one or both hands of the individual. Depending on the condition, energy transfer may be ceased when an event occurs. For example,

when energy is transferred in order to alleviate a disorder associated with a lymph node, wherein the disorder is characterized by localized pulsations at the closest exterior body surface, energy transfer may be terminated when the localized pulsations are no longer detectable. Similarly, when energy transfer is effected to drain a portion of a lymphatic system, energy transfer may be terminated when at least some lymphatic drainage has occurred at the desired portion of the lymphatic system. Moreover, if energy is transferred to alleviate pain, pain elimination may signal that energy transfer should be terminated. As a general matter, then, there are a variety of indications of successful of lymphatic treatment using the inventive method. These indications include, but are not limited to: (1) softening of hardened affected lymphatic regions; (2) a gurgling sound associated with of lymphatic decongestion; (3) a noise that accompany improved vein and/or arterial flow; (4) a clicking bone connecting sound; (5) prickly sensation experienced by a patient that accompanies healing of nerves; (6) recovery of muscle mass; (7) pain elimination; (8) subsiding of swelling; (9) improved breathing; (10) improved oxygen transport to the lungs, stomach and other organs; (11) relaxation of organ stress (12) hydrocephaly reduction; and (13) reduced fever.

Accordingly, the present invention provides a new method for alleviating a disorder associated with a portion of the lymphatic system such as a lymph node in a living mammalian body condition. A number of important and heretofore unrealized advantages have now been achieved that include, but are not limited to, the following:

the method is non-invasive in nature, and undesirable effects resulting from surgical procedures, e.g., infection, pain and adverse reaction to anaesthesia, are eliminated;

the method requires no pharmacologically active agent and thus eliminates the possibility of adverse reactions to such agents, e.g., allergic or autoimmune responses or adverse drug interactions.

the method does not require complicated ***electrical*** or mechanical apparati that may fail due to faulty ***electrical*** connections or wear and tear; and

unlike CDT, the method may be carried out even when the patient suffers from lymphangitis or blockage of non-surface lymph nodes.

It is to be understood that while the invention has been described in conjunction with the preferred specific embodiments thereof, that the foregoing description is intended to illustrate and not limit the scope of the invention. Other aspects, advantages and modifications within the scope of the invention will be apparent to those skilled in the art to which the invention pertains.

Methods and apparatus for electrical microcurrent stimulation therapy (pgs 149-173)

United States Patent **6,275,735**
Jarding , et al. **August 14, 2001**

Abstract

A method and apparatus for providing ***microcurrent*** stimulation therapy to a body part is disclosed. In one embodiment, a method allows digital control of the modulation frequency of the ***microcurrent*** signal. The method includes receiving a first digital data word which is used to produce a first frequency related to the first digital data word, whereupon, a first ***microcurrent*** signal at the first frequency is applied to the body part. A second digital data word is received and used to produce a second frequency related to the second digital data word. A second ***microcurrent*** signal at the second frequency is applied to the body part. In another embodiment, a method allows direct digital synthesis of the ***microcurrent*** stimulation signal. A first digital data word is used to produce a first analog voltage which is applied to the body part. A second digital data word is used to produce a second analog voltage which is also applied to the body part, where the first analog voltage is different from the second analog voltage. In yet another embodiment, an apparatus for providing ***microcurrent*** stimulation therapy includes a digital-to-analog converter, a controller and a plurality of data words. The controller is coupled to the digital-to-analog converter and supplies the digital-to-analog converter with digital data words in order to generate an ***electrical*** signal for the ***microcurrent*** stimulation therapy.

Inventors: **Jarding; John B.** (Hot Springs, SD); **O'Clock; George D.** (North Mankato, MN) Assignee:
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Current U.S. Class: **607/53**; 607/66; 607/68
Intern'l Class: A61N 001/32; A61N 001/36
Field of Search: 607/53,66-69,54

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Parent Case Text

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation-in-part of and claims the benefit of U.S. patent application Ser. No. 09/114,815, filed Jul. 13, 1998, now U.S. Pat. No. 6,035,236, the disclosure of which is incorporated by reference.

Claims

What is claimed is:

1. A method for providing ***microcurrent*** stimulation therapy to a body part, comprising the steps of:

receiving a first digital data word;

producing a first frequency related to the first digital data word;

applying a first ***microcurrent*** signal at the first frequency to the body part;

receiving a second digital data word;

producing a second frequency related to the second digital data word;

applying a second ***microcurrent*** signal at the second frequency to the body part proximate an eye, and

limiting a current level of the first and second ***microcurrent*** signals applied to the body part.

2. The method as recited in claim 1, wherein the stimulation therapy comprises therapy for treating visual system diseases, and the applying steps include applying the ***microcurrent*** signal to an eyelid proximate an eye having a visual system disease.

3. The method as recited in claim 1, wherein the therapy treats at least one of macular degeneration, retinitis pigmentosa, sciatica, pain disorders, fatigue disorders, myofascial pain syndrome, fibromyalgia, neuralgia, and ***cancer***.

4. The method as recited in claim 1, wherein the first ***microcurrent*** signal comprises a waveform selected from a group of waveforms comprising a sine wave, a square wave, a triangular wave, a ramp wave, a step wave, an unipolar wave, a bipolar wave, and a bi-phasic wave.

5. The method as recited in claim 1, further comprising the step of limiting a voltage level of the first and second ***microcurrent*** signals applied to the body part.

6. The method as recited in claim 1, wherein a current level is in the range of about 50 microamps to about 200 microamps.

7. A method for providing ***microcurrent*** stimulation therapy to a body part, comprising the steps of:

receiving a first digital data word;

producing a first analog voltage related to the first digital data word;

applying the first analog voltage to the body part;

inducing a first ***microcurrent*** to flow with the first analog voltage;

receiving a second digital data word;

producing a second analog voltage related to the second digital data word;

applying the second analog voltage to the body part proximate an eye having an affliction, wherein the first analog voltage is different from the second analog voltage; and

inducing a second ***microcurrent*** to flow with the second analog voltage.

8. The method as recited in claim 7, wherein the therapy treats at least one of macular degeneration, retinitis pigmentosa, sciatica, pain disorders, fatigue disorders, myofascial pain syndrome, fibromyalgia, neuralgia, and ***cancer***.

9. The method as recited in claim 7, further comprising the step of producing a periodic waveform which includes the first and second analog voltages, wherein the periodic waveform is selected from the group of waveforms comprising sine wave, square wave, triangular wave, ramp wave, step wave, unipolar wave, bipolar wave, and bi-phasic wave.

10. The method as recited in claim 7, further comprising the step of limiting a current level of the first and second analog voltages applied to the body part.

11. The method as recited in claim 7, further including the step of repeating the forgoing steps a plurality of times to produce a periodic waveform.

12. An apparatus for supplying an ***electrical*** signal to a body part in order to provide ***microcurrent*** stimulation therapy to the body part, comprising:

a digital-to-analog converter;

a controller coupled to the digital-to-analog converter;

a current limiter coupled to the ***electrical*** signal; and

a plurality of digital data words, wherein the controller couples the digital data words to the digital-to-analog converter in order to generate the ***electrical*** signal.

13. The apparatus as recited in claim 12, further comprising a voltage controlled oscillator, wherein:

the digital-to-analog converter produces an analog voltage which is coupled to the voltage controlled oscillator; and

the analog voltage relates to an output frequency of the voltage controlled oscillator.

14. The apparatus as recited in claim 12, wherein a look-up table includes the plurality of digital data words.

15. The apparatus as recited in claim 12, wherein the digital data words are stored in a reprogrammable and non-volatile memory.

16. The apparatus as recited in claim 12, wherein the digital-to-analog converter produces a plurality of voltages which form a periodic waveform.

17. The apparatus as recited in claim 12, further comprising a current limiting circuit coupled to the digital-to-analog converter.

18. The apparatus as recited in claim 12, further comprising a current level indicator which conveys the current level of the ***electrical*** signal.

19. The apparatus as recited in claim 12, further comprising a current measuring device adapted to measure the current level of the ***electrical*** signal.

20. The apparatus as recited in claim 12, further comprising a data acquisition module for collecting current and voltage level information.

21. A method for providing ***microcurrent*** stimulation signals capable of providing therapy to a body part, comprising the steps of:

receiving a first digital data word;

producing a first ***microcurrent*** signal related to the first data word;

receiving a second digital data word;

producing a second ***microcurrent*** signal related to the second data word; and

treating at least one of macular degeneration, retinitis pigmentosa, sciatica, fatigue disorders, myofascial pain syndrome, fibromyalgia, neuralgia, and *cancer*.

22. A method for providing ***microcurrent*** stimulation signals capable of providing therapy to a body part, comprising the steps of:

receiving a data word;

producing a ***microcurrent*** signal related to the data word; and

applying the ***microcurrent*** signal to a point proximate to an eye having a visual system disease.

23. A method for providing ***microcurrent*** stimulation signals capable of providing therapy to a body part, comprising the steps of:

receiving a data word;

producing a ***microcurrent*** signal related to the data word; and

treating at least one of macular degeneration, retinitis pigmentosa, sciatica, fatigue disorders, myofascial pain syndrome, fibromyalgia, neuralgia, and ***cancer***.

Description

BACKGROUND OF THE INVENTION

The present invention relates generally to methods and apparatus for ***electrical microcurrent*** stimulation therapy, and more particularly to methods and apparatus for providing ***electrical microcurrent*** stimulation around an eye to combat visual system diseases, such as macular degeneration.

Chronic pain is a problem for millions of individuals throughout the world. One method of treating such pain is to provide ***microcurrent*** stimulation around or near the areas where the pain is occurring. ***Microcurrent,*** which typically is defined as current below 1 milliamp, can provide rapid and long-lasting pain relief for a wide variety of pain syndromes. Generally, ***microcurrent*** stimulation therapy typically comprises applying a current in the range of about 20 to about 300 microamps to the affected area. The current or ***microcurrent*** blocks neuronal transmission of pain signals and stimulates the release of endorphins to help relieve the pain in chronic and acute pain patients.

While the current level can be an important factor in ***microcurrent*** stimulation therapy, frequency modulation and the waveform of the ***electrical*** signal are also important. Some ***electrical*** stimulation therapy devices currently known in the art typically allow the user to manually adjust the frequency ranges and types of waveform signals applied to the patient. For example, the MicroStim 400 device, manufactured by MicroStim, Inc., located in Tamarac, Fla., features a combination of a carrier waveform having a modulated frequency thereon. The MicroStim device is covered by U.S. Pat. No. 4,989,605, issued on Feb. 5, 1991 to Joel Rossen and entitled "Transcutaueous ***Electrical*** Nerve Stimulation (TENS) Device", the contents of which is incorporated herein by reference. The theory behind the MicroStim 400 device is that the carrier wave is designed to take the modulated frequency deep into the body for consistent and rapid pain relief. However, a disadvantage of the MicroStim 400 device is that the signal that it generates produces most of its power at individual frequencies 105. That is, when viewing the signal produced by the MicroStim 400 in the frequency domain, the majority of the power output from the signal resides at discrete frequencies. Accordingly, the therapeutic effect of the signal may not be maximized.

Another device which can be used for ***microcurrent*** stimulation therapy is the Amrex Z-Stim device manufactured by Amrex, Corp. of Carson, Calif. The Z-Stim device is a multi-signal interferential stimulator that provides multiple swept frequency sinusoidal signals. The applications for sinusoidal signals are more appropriate for muscle stimulation and addressing problems associated with pain, edema and rehabilitation for certain neuromuscular and orthopedic problems.

In addition to chronic pain relief, ***microcurrent*** therapy is being used to treat a number of visual system diseases, including macular degeneration and retinitis pigmentosa.

Age-related macular degeneration (AMD) is the leading cause of legal blindness in the United States in persons over 65 years old. According to a March 1997 Review of Optometry Journal, 10% of our population over age 52 has AMD and 33% of individuals over

age 75 have AMD. It is estimated that more than 13 million Americans now have AMD and that, by the time the Baby Boomers reach age 65, there will be over 30 million cases of AMD, almost 25% of our population over 65.

Normal retinal cell function is a photochemical reaction converting light energy to an ***electrical*** impulse which travels to the brain and vision occurs. With AMD and other visual system diseases, diseased, inflamed retinal cells eventually lose cell function. Adenosine triphosphate (ATP) levels drop, protein synthesis drops, the ***electrical*** resistance goes up, and cell membrane ***electrical*** potential goes down. Basically, the cells seem to go dormant for a time before they die. It is believed that, if ***electrical*** stimulation is provided to the cells before they die, blood vessel permeability is increased, a more normal cellular ***electrical*** potential will be achieved, the ATP levels will increase, protein synthesis will occur again, and normal cell metabolism will be restored. In addition, ***electrical*** stimulation appears to have a healing effect on the small blood vessels in the retina, promoting a more efficient delivery of nutrients to the retinal cells and a more efficient uptake of proteins that can accumulate on the retina. Thus, it is believed that ***microcurrent*** stimulation will help rejuvenate the cells in the retina to slow or stop degeneration of the eye due to AMD. With the proper ***microcurrent*** stimulation waveform and therapy procedures, AMD may be slowed or stopped in a large number of people suffering from the disease.

While ***microcurrent*** stimulation therapy has been used to treat AMD and other visual system diseases, the methods and apparatus used in the prior art do not appear to maximize the therapeutic effect. For example, as mentioned briefly above, the devices for providing ***microcurrent*** stimulation therapy are limited in the types of waveforms and frequency ranges which they may provide for therapy.

SUMMARY OF THE INVENTION

Accordingly, it is an advantage of the present invention to provide novel methods and apparatus for providing ***microcurrent*** stimulation therapy to a body part to combat chronic pain, injury, or disease in that body part.

Another advantage of the present invention is to provide methods and apparatus for treating various diseases, including macular degeneration and retinitis pigmentosa.

Yet another advantage of the present invention is to provide an apparatus which generates unique waveforms that can be used for ***microcurrent*** stimulation therapy. The unique waveforms produce a spectral response desired for treating the disease of interest.

Still another advantage of the present invention is to provide an apparatus which can produces unique waveforms under digital control by using either digitally controlled frequency modulation or direct digital synthesis. Digital control can provide more precision and versatility in the control of the spectral output for ***microcurrent*** therapy.

The above and other advantages of the present invention are carried out in one embodiment by an apparatus for supplying an ***electrical*** signal to a body part in order to provide ***microcurrent*** stimulation therapy to the body part. In this embodiment, the apparatus includes a digital-to-analog converter, a controller and a plurality of data words. The controller is coupled to the digital-to-analog converter and

supplies the digital-to-analog converter with digital data words in order to generate an ***electrical*** signal to a voltage controlled oscillator which serves as the basic source for the ***microcurrent*** stimulation therapy.

In another embodiment, a method allows digital control of the modulation frequency of the ***microcurrent*** signal preferably using a look-up table. The method includes receiving a first digital data word which is used to produce a first frequency related to the first digital data word, whereupon, a first ***microcurrent*** signal at the first frequency is applied to the body part. A second digital data word is received and used to produce a second frequency related to the second digital data word. A second ***microcurrent*** signal at the second frequency is applied to the body part.

In yet another embodiment, a method allows direct digital synthesis of the ***microcurrent*** stimulation signal. A first digital data word is used to produce a first analog voltage which is applied to the body part. A second digital data word is used to produce a second analog voltage which is also applied to the body part, where the first analog voltage is different from the second analog voltage.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention may be derived by referring to the detailed description and claims when considered in connection with the figures, wherein like reference numbers refer to similar items throughout the figures, and:

FIG. 1 is a diagram of a ***microcurrent*** stimulation therapy apparatus having a ***microcurrent*** signal generator and a probe for applying the ***microcurrent*** to a body part;

FIG. 2 is a block diagram of a circuit embodying the ***microcurrent*** signal generator of FIG. 1;

FIG. 3 is a detailed circuit diagram of one embodiment of the ***microcurrent*** signal generator circuit of FIG. 2;

FIG. 4a illustrates eight therapy points around an eyelid to which ***microcurrent*** stimulation therapy may be applied in accordance with a method for treating visual system diseases;

FIG. 4b illustrates eight therapy points on the back of the neck to which ***microcurrent*** stimulation therapy may be applied in accordance with a method for treating visual system diseases;

FIG. 4c illustrates ten therapy points on the ear to which ***microcurrent*** stimulation therapy may be applied in accordance with a method for treating visual system diseases;

FIG. 4d illustrates four therapy points on an arm to which ***microcurrent*** stimulation therapy may be applied in accordance with a method for treating visual system diseases;

FIG. 5a illustrates a periodic sinusoidal wave signal having a set frequency which is a waveform signal generated by a prior art ***microcurrent*** generator;

FIG. 5b illustrates the spectral or frequency response of the sinusoidal wave signal of FIG. 5a;

FIG. 6a illustrates a periodic square wave having a set frequency which is a waveform signal generated by a prior art ***microcurrent*** generator;

FIG. 6b illustrates the spectral or frequency response of the square wave signal of FIG. 6a;

FIG. 7a is a swept sinusoidal waveform signal varying from about 0 Hz to about 125 Hz over a time frame in excess of 100 microseconds;

FIG. 7b is the spectral or frequency response of the waveform signal of FIG. 7a;

FIG. 8a is a swept sinusoidal waveform varying from about 0 Hz to about 1.1 MHz over a time frame in excess of 1 microseconds;

FIG. 8b is the spectral or frequency response of the waveform signal of FIG. 8a;

FIG. 9 is an embodiment which allows digital control of the modulation frequency;

FIG. 10 is an embodiment which produces the output waveform using direct digital synthesis;

FIG. 11 is an embodiment of a triangular waveform;

FIG. 12 is an embodiment of a ramp waveform;

FIG. 13A is a first embodiment of bi-phasic pulses; and

FIG. 13B is a second embodiment of bi-phasic pulses.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

The present invention comprises methods and apparatus for providing ***microcurrent*** simulation therapy for the treatment of chronic pain, visual system diseases and other bodily defects or diseases. More particularly, the present invention relates to a ***microcurrent***

waveform generator which generates sweep wave signals for use in ***microcurrent*** stimulation therapy. As discussed in more detail below, the ***microcurrent*** sweep wave generator disclosed herein may be used for any type of ***microcurrent*** stimulation therapy and will find its greatest use in treating patients suffering from macular degeneration.

In addition, the present invention relates to a novel method for treating visual system diseases such as macular degeneration and retinitis pigmentosa using ***microcurrent*** stimulation therapy techniques.

With reference to FIG. 1, a novel ***microcurrent*** stimulation therapy apparatus 10 is shown in accordance with the present invention. Therapy apparatus 10 preferably comprises a sweep wave signal generator 12, a stimulation probe 14, and an electrode 16. Preferably, stimulation probe 14 is connected to sweep wave signal generator 12 via a first ***electrical*** connector 18, and electrode 16 is connected to sweep wave signal generator 12 via a second ***electrical*** connector 20. As illustrated in FIG. 1, a probe tip 22 preferably is connected to the end of stimulation probe 14 opposite the end of probe 14 connected to first ***electrical*** connector 18.

Stimulation probe 14 preferably comprises a shielded hand-held probe configured to administer ***microcurrent*** stimulation to various points on one or more body parts. In accordance with a preferred embodiment of the present invention, probe tip 22 preferably comprises a cotton swab moistened or dampened with a conductive gel. The dampened cotton swab allows for the gentle administration of the ***microcurrent*** to the body part without undue discomfort. However, while one embodiment of the present invention illustrates a probe tip 22 as being a cotton swab, one skilled in the art will appreciate that other types of probe tips may be used. For example, probe tip 22 may be made from a variety of different metals like copper, brass, aluminum, or the like, or probe tip 22 may be made from metal combinations or other conductive materials. In any event, any suitable probe tip may be used and, thus, the present invention is not limited to the illustrated embodiment.

In accordance with a preferred embodiment of the present invention, electrode 16 preferably comprises a handheld brass electrode. As one skilled in the art will appreciate, when a patient receiving ***microcurrent*** stimulation therapy holds electrode 16, a closed circuit is created with stimulation probe 18. That is, by holding electrode 16, current from probe 18 will travel through the body, to brass electrode 16 and back to sweep wave signal generator 12.

While the illustrated embodiment shows a handheld brass electrode 16, any electrode configuration may be used. For example, electrode 16 may be a conductive clip device which attaches to a body part such as a finger, ear, arm or the like.

As discussed briefly above, first ***electrical*** connector 18 is configured to connect stimulation probe 14 to sweep wave signal generator 12, and second ***electrical*** connector 20 is configured to connect electrode 16 to sweep wave signal generator 12. In the illustrated embodiment, first and second ***electrical*** connectors 18 and 20 each preferably include a first connector end 24 for connection to generator 12 and a second connector end 26 for connection to stimulation probe 14 and electrode 16, respectively. In accordance with this aspect of the invention, connectors 18 and 20 are removable from generator 12 and probe 14 and electrode 16.

In accordance with an alternative embodiment of the present invention, connectors 18 and 20 may be hardwired to generator 12, or to probe 14 and electrode 16, or to both generator 12 and probe 14 and electrode 16. In addition, in accordance with yet another alternative embodiment of the present invention, ***electrical*** connectors 18 and 20 may comprise any suitable ***electrical*** connection device currently known in the art or hereinafter developed.

Still referring to FIG. 1, a more detailed description of sweep wave signal generator 12 will now be discussed. As discussed in detail below, sweep wave signal generator 12 preferably is configured to generate one or more sweep wave signals having various waveform, sweep frequency, sweep time, duty cycle, center frequency, frequency window, and amplitude characteristics. In accordance with a preferred embodiment of the invention, the generated sweep wave signal(s) are frequency varied signals. That is, the frequency of the signals vary over time.

To generate the different sweep wave signals, sweep wave signal generator 12 may produce a single sweep wave signal, or alternatively, sweep wave signal generator 12 may generate a composite signal comprising two independent swept wave signals or a swept wave signal and a non-swept wave signal. In accordance with this aspect of the present invention, sweep wave signal generator 12 preferably comprises a first waveform control 32 and a second waveform control 34. First waveform control 32 preferably controls the waveform type of a first sweep wave signal, and second waveform control 34 preferably controls the waveform type of a second sweep wave signal. First and second waveform controls 32 and 34 may be adjusted to produce a variety of different sweep waveforms. For example, by adjusting first and second controls 32 and 34, generator 12 will produce different waveforms, including sinusoidal waveforms, ramp waveforms, triangular waveforms, rectangular or square waveforms, step waveforms, window waveforms, unipolar waveforms, bipolar or bi-phasic waveforms or steady-state DC signals, to name a few. By combining different waveform types having different sweep frequencies and sweep times, a large variety of therapeutic sweep waves may be generated.

In addition to controlling the type of waveforms generated, sweep wave signal generator 12 preferably is configured to control the range of frequencies between which the selected waveforms sweep, as well as the sweep time for performing the sweep of frequency ranges. In accordance with this aspect of the invention, generator 12 preferably has a first low frequency control 36, a first high frequency control 38, a first sweep time control 39, a second low frequency control 40, a second high frequency control 42, and a second sweep time control 43. First low frequency control 36 preferably controls the low frequency threshold for the first sweep wave signal, first high frequency control 38 controls the high frequency threshold of the first sweep wave signal, and first sweep time control 39 controls the sweep time of the first sweep wave signal. Similarly, second low frequency control 40 preferably controls the low frequency threshold of the second sweep wave signal, second high frequency control 42 controls the high frequency threshold of the second sweep wave signal, and second sweep time control 43 controls the sweep time of the second sweep wave signal.

In accordance with a preferred embodiment of the present invention, the low frequency thresholds for both sweep wave signals may be in the range of about 0 Hz to about 400 Hz. Similarly, the high frequency threshold for the two sweep wave signals may be in the range of about 0 Hz to about 2000 Hz. The sweep time for both the first and the second sweep wave signals preferably is in the range of about 7 seconds to about 60 seconds, and more preferably about 15 seconds. While the illustrated embodiment shows a low

frequency control and a high frequency control for each sweep wave signal, one skilled in the art will appreciate that any frequency control scheme may be used. For example, each sweep wave signal may have only one frequency control, or one low and one high frequency control may control both sweep wave signals. In any event, the present invention is not limited to the illustrated embodiment.

Still referring to FIG. 1, sweep wave signal generator 12 preferably further comprises a voltage signal control 44, a current control 46, a first signal monitor port 50, a second signal monitor port 52, and a data-acquisition system port 54.

As discussed in more detail below with reference to FIGS. 2 and 3, sweep wave signal generator 12 preferably further comprises a voltage limiting circuit and a current limiting circuit. In accordance with this aspect of the invention, voltage control 44 is configured to control the magnitude of the voltage signal peak or peak-to-peak output. Similarly, current control 46 preferably is configured to control the current supplied to the body part of the patient by controlling the current limiting circuit.

As discussed in greater detail below, sweep wave signal generator 12 may be connected to one or more oscilloscopes, spectrum analyzers or waveform displays via first and second signal monitor ports 50 and 52. By connecting generator 12 to one or more oscilloscopes, spectrum analyzers, or waveform displays, the waveform signal and current level at various locations within the generator circuit can be monitored. In addition, sweep wave signal generator 12 may further include a data-acquisition port 54 for connecting generator 12 to a data-acquisition system and/or a strip chart recorder. In accordance with this aspect of the present invention, generator 12 preferably is configured to record various data, such as waveform, current and voltage levels, and the like for different patients, and then download the data to a data-acquisition system for monitoring and analysis. In this manner, a doctor or practitioner can analyze data concerning variations in current levels between patients and different diseases of the visual system, as well as variations in the swept waveform for different patients and disease states. The doctor or practitioner can then use this data to track therapy progress, develop better therapy procedures for different patients, and monitor variabilities in treatment points. In addition, the doctor or practitioner can monitor probe contact consistency and patient progress for self-administered therapy patients. That is, for patients who use or administer the micro-current stimulation therapy to themselves, at home, the doctor or practitioner can use the collected data to determine whether the patient is administering the therapy correctly and whether the therapy protocol needs to be adjusted for that particular patient.

As one skilled in the art will appreciate, sweep wave signal generator 12 may include both voltage control 44 and current control 46, or generator 12 may be configured with only one of the two controls. For example, by controlling the magnitude of the voltage output signal for a given patient impedance, the current supplied to the patient is also controlled. Similarly, by controlling the current supplied to a patient having a given impedance, the voltage is also controlled. Thus, the present invention is not limited to the illustrated embodiment. In addition, while the illustrated embodiment of sweep wave signal generator 12 shows a number of different control features, one skilled in the art will appreciate that certain control features may be eliminated and other control features may be added without departing from the spirit of the invention. For example, while not illustrated in the figures, sweep wave signal generator 12 may further comprise duty cycle controls for controlling the duty cycles of the first and second sweep wave signals.

Finally, sweep wave signal generator 12 preferably further comprises a current level indicator 48, a first frequency indicator 49-1, and a second frequency indicator 49-2. In accordance with this aspect of the invention, current level indicator 48 preferably displays the current being supplied to the patient. Current level indicator 48 may be configured to display root-mean-square (rms) or average current output for certain segments of treatment time.

In addition, in accordance with one embodiment of the present invention, first and second frequency indicators 49-1 and 49-2 preferably are configured to display the frequency of the first and second sweep wave signals, respectively, as the signal sweeps through the frequency ranges. Alternatively, in accordance with another embodiment of the present invention, first and second frequency indicators 49-1 and 49-2 may be configured to display the frequency ranges between which the first and second sweep waves are to sweep.

Referring now to FIG. 2, a block circuit diagram of one embodiment of a sweep wave signal generator circuit 55 is illustrated. In accordance with a preferred embodiment of the present invention, sweep wave signal generator circuit 55 preferably comprises a first sweep signal generator 60, and a second sweep signal generator 62. Both first and second sweep wave signal generators 60, 62 preferably comprise a sweep control circuit 64 and a signal generator 66. Sweep control circuit 64 preferably controls the sweep frequencies, sweep times and duty cycles of the signals, and signal generator 66 preferably generates a particular waveform having the sweep frequencies, sweep times and duty cycles dictated by control circuit 64. First and second sweep wave signal generators 60 and 62 may be configured to generate swept waves, or non-swept waves. For example, by setting the high and low sweep frequencies to the same frequency for a particular signal, the signal generator will generate a signal having a set frequency.

As one skilled in the art will appreciate, first and second sweep signal generators 60 and 62 may comprise any suitable sweep signal generator currently known in the art. For example, function generator with sweep control, product no. PM5132, manufactured by Philips Corporation, may be used. As discussed briefly above, sweep signal generator 60 and 62 may be configured to generate a wide variety of waveforms having a variable range of sweep frequencies and sweep times.

In accordance with the embodiment illustrated in FIG. 2, first sweep signal generator 60 preferably generates a first sweep wave signal 68 and second sweep signal generator 62 preferably generates a second sweep wave signal 70. A signal combiner/adder circuit 72 preferably receives first sweep wave signal 68 and second sweep wave signal 70 and combines the two signals into a single sweep wave signal 74. From combiner/adder circuit 72, sweep wave signal 74 preferable passes to a buffer/amplifier circuit 76, which is configured to amplify and buffer single sweep wave 74, generating a buffered sweep wave signal 78.

In accordance with one embodiment of the present invention, buffered sweep wave signal 78 preferably passes into a voltage clipping or limiting circuit 80, which is configured to control the polarity of the output voltage to a predetermined voltage level and polarity. The output of clipping or limiting circuit 80 is a clipped voltage signal 82 which preferably passes to a current limiting circuit 84 configured to limit the total current output supplied to a particular body part. Connected to current limiting, circuit 84 is a current level

indicator 86, which preferably is a volt meter configured to monitor and display the output current level.

As mentioned briefly above, sweep wave signal generator 12 preferably comprises a voltage control 44 and a current control 46. In accordance with this aspect of the invention, voltage control 44 preferably is configured to control the voltage signal peak or peak-to-peak output from voltage clipping or limiting circuit 80. For example, by adjusting voltage signal control 44, voltage clipping or limiting circuit 80 is adjusted so that the amplitude of the output voltage changes as necessary. Similarly, current control 46 of signal generator 12 preferably is configured to control the current output from current limiting circuit 84.

Current level indicator 86 may comprise any suitable current measuring and displaying device. As discussed in more detail below with reference to FIG. 3, current level indicator 86 may comprise, for example, a voltage measuring device configured across current limiting circuit 84. As one skilled in the art will appreciate, the amount of current flowing through current limiting circuit 84 is a function of the voltage across the circuit, as well as the resistance of the circuit itself. Once the current level is determined, current level indicator 86 preferably displays the current level on current level display 48 of signal generator 12 (see FIG. 1). Current level indicator 86 can be configured to measure the root-mean-square (RMS) current, or indicator 86 may be configured to measure an average current over a particular time period.

In accordance with another preferred embodiment of the present invention, signal generator circuit 55 may be configured without voltage clipping or limiting circuit 80. In accordance with this preferred embodiment of the invention, amplified sweep wave signal 78 passes directly to current limiting circuit 84. This particular embodiment of the invention is illustrated in FIG. 2 as dotted line 78 passing into circuit 88 comprising current limiting circuit 84 and current level indicator 86. In accordance with this second embodiment of the present invention, current limiting circuit 84 and current level indicator 86 preferably operate in the same general manner as that described above with reference to the first embodiment. Accordingly, a detailed discussion of circuit 88 will not be discussed further.

In accordance with yet another embodiment of the present invention, sweep wave signal generating circuit 55 may further comprise connections 90 and 92 for connection to one or more oscilloscopes, spectrum analyzers or waveform displays. As illustrated in FIG. 2, in accordance with a preferred embodiment of the present invention, signal generating circuit 55 preferably has two connections, one prior to voltage clipping or limiting circuit 80 and one after voltage clipping or limiting circuit 80. In accordance with this aspect of the invention, an oscilloscope, spectrum analyzer, or waveform display connected to connection 90 will display the waveform of the sweep wave signal from buffer/amplifier circuit 76, and the second oscilloscope, spectrum analyzer, or waveform display connected to connection 92 will display the sweep wave signal after it has passed through voltage clipping or limiting circuit 80. Accordingly, the operator of the device can be sure that voltage clipping or limiting circuit is functioning properly by analyzing the signals entering and leaving the circuit. In the embodiment in which the voltage clipping or limiting circuit is eliminated, only one connection to an oscilloscope or spectrum analyzer is present.

In addition, as mentioned briefly above, the sweep wave signal generator circuit 55 may further comprise a data acquisition module 94

for collecting data about the performance of the therapy device, and in particular, generator circuit 55. For example, in accordance with the illustrated embodiment, data acquisition module 94 preferably is connected so that it can monitor first and second sweep waves 68 and 70, buffered sweep wave signal 78, clipped voltage signal 82, and the current and voltage of the output signals. In accordance with this aspect of the invention, the collected data can then be downloaded to data acquisition system for analysis by a doctor or therapist. As one skilled in the art will appreciate, the data acquisition system may comprise any suitable data acquisition system, such as a computer system configured to manipulate and display such data.

Referring now to FIG. 3, a detailed circuit diagram of one embodiment of sweep wave signal generating circuit 55 is illustrated. In accordance with the illustrated embodiment in FIG. 3, signal generating circuit 55 preferably comprises a first sweep wave signal generator 60, a second sweep wave signal generator 62, a signal combiner or adder circuit 72 a buffer/amplifier circuit 76, a voltage limiting or clipping circuit 80, a current limiting circuit 84 and a current level monitor/indicator 86.

In accordance with this particular embodiment of the present invention, signal adder or combiner circuit 72 and buffer/amplifier circuit 76 preferably are combined into a single operational amplifier circuit 100. Op amp circuit 100 preferably receives a first sweep wave signal 102 from first sweep wave signal generator 60 and a second sweep wave signal 104 from second sweep wave signal generator 62. In accordance with this aspect of the invention, first sweep wave signal 102 is connected to negative input terminal 112 of an op amp 110 through a first resistor 106, and second sweep wave signal 104 is connected to negative input terminal 112 of op amp 110 through a second resistor 108. First resistor 106 and second resistor 108 preferably are in the range of about 1 kiloohm to about 25 kiloohms, and more preferably are about 10 kiloohms.

Op amp 110 further comprises a positive input terminal 114 which preferably is connected to ground, and an output terminal 116 which preferably is connected in a negative feedback loop to negative input terminal 112 through a variable resistor 118. In accordance with a preferred embodiment of the present invention, variable resistor 118 may have a variable resistance which ranges between about 1 to about 50 kiloohms, and more preferably ranges between about 3.3 to about 7.8 kiloohms.

While one embodiment of the present invention disclosed herein utilizes an op amp as a signal adder and buffer amplifier, one skilled in the art will appreciate that other circuit configurations may be used to accomplish the amplifier, adder, and buffering tasks. Thus, the present invention is not limited to an embodiment comprising an op amp circuit.

From operational amplifier circuit 100, a single sweep wave signal 120 passes into voltage clipping or limiting circuit 80. In accordance with this aspect of the invention, voltage clipping or limiting circuit 80 preferably comprises a diode 22 and a variable resistor 124. Variable resistor 124 is connected between a first terminal of diode 122 and ground. With this particular configuration, the adjustment of variable resistor 124 preferably adjusts the limit of the voltage amplitude output. In accordance with a preferred embodiment of the invention, variable resistor 124 preferably has a resistance which ranges between about 5 to about 50 kiloohms, and more preferably between about 15 to about 25 kiloohms.

While the illustrated embodiment of the present invention shows voltage clipping or limiting circuit 80 comprising a resistor/diode combination, one skilled in the art will appreciate that any voltage limiting circuit configuration may be used. For example, instead of a diode/resistor combination, voltage clipping or limiting circuit 80 may comprise an operational amplifier configured as a limiting circuit. Therefore, the present invention is not limited to the illustrated embodiment.

From voltage limiting circuit 80, a clipped wave signal 126 preferably passes into current limiting circuit 84. In accordance with the illustrated embodiment of the invention, current limiting circuit 84 comprises a resistor 128. As one skilled in the art will appreciate, since current equals the voltage divided by the resistance (I=V/R), the higher the value of the resistor 128, the lower the current output. In accordance with the preferred embodiment of the invention, resistor 128 preferably has a value between about 10 and about 500 kiloohms, and more preferably a value between about 20 kiloohms and about 115 kiloohms.

While the illustrated embodiment shows resistor 128 as a constant resistance value, one skilled in the art will appreciate that to have a controllable or variable current output, it may be desirable to replace constant resistor 128 with a variable resistor. In addition, while current limiting circuit 84 is shown as a resistor, any suitable current limiting circuit configuration may be used. For example, a circuit comprising transistors, resistors, diodes, and the like may be used instead of a simple resistor.

As discussed above, current level monitor/indicator 86 is configured to measure the current output from current limiting circuit 84. In the illustrated embodiment, current level monitor/indicator 86 preferably comprises a device which is configured to measure the voltage across resistor 128, which in turn will give the current flowing through the resistor. However, other current monitoring devices or circuits may be used. In addition, as discussed above with reference to FIG. 2, circuit 55 may further comprise a data acquisition module for collecting therapy and waveform data.

The fundamental difference between the swept and the non-swept waveform is the continuous nature of the spectral characteristics and the time-frequency variation with analog waveforms, and the almost continuous nature (i.e., somewhat discrete) for the spectral characteristics of a swept digital or pulsed waveform. There appears to be some evidence that the human body behaves like a dispersive filter and a waveform that is swept in the appropriate manner may be preferred for electro-therapy. Also, since the physiology and body chemistry for each patient varies, the swept waveform is more likely to provide the optimal frequency which maximizes the therapeutic value for large numbers of people afflicted with various types of visual system diseases.

Referring now to FIGS. 5a, 5b, 6a, 6b, 7a, 7b, 8a, and 8b, fundamental differences between discreet frequency wave signals and sweep wave signals is illustrated. Specifically, FIG. 5a illustrates a 2 volt (peak-to-peak) sinusoidal waveform having a set frequency of about 3 MHz. This type of waveform is a typical analog waveform generated by ***microcurrent*** stimulation devices currently known in the art. As illustrated in FIG. 5b, the spectral or frequency components of the sinusoidal waveform appear at only one discreet frequency. With this type of signal, all of the power from the signal is located at or near the 3 MHz frequency.

FIG. 6a illustrates a 3.2 volt (peak-to-peak) rectangular waveform having a peak overshoot and a frequency of about 6 MHz. Again,

this waveform type is a typical digital or pulsed waveform produced by ***microcurrent*** stimulation devices currently known in the art. As illustrated in FIG. 6b, the rectangular waveform has a fundamental frequency component at 6 MHz and diminishing harmonics at 18, 30 and 42 MHz, respectively. With this type of signal, approximately 80% of the power is associated with the fundamental frequency of 6 MHz.

Referring now to FIG. 7a, a 10 volt (peak-to-peak) swept sinusoidal waveform varying from about 0 Hz to about 125 Hz over a time frame of more than 100 microseconds is shown. As illustrated in FIG. 7a, the frequency of the waveform changes with time. FIG. 7b shows the frequency or spectral characteristics of the waveform of FIG. 7a. Specifically, as illustrated FIG. 7b, the frequency or spectral characteristics of the swept analog waveform are continuous, not discreet, like they are with the fixed frequency signal of FIGS. 5b. Thus, the power is not concentrated at one or a few frequencies, but is spread over the entire frequency range. The power at any discreet frequency in the spectrum is 0 watts.

Finally, FIG. 8a illustrates a 10 volt (peak-to-peak) swept sinusoidal waveform varying from 0 Hz to 1.1 MHz over a time frame of more than 100 microseconds is shown. Again, as shown in FIG. 8b, the frequency or spectral characteristics of the swept analog waveform is continuous over the wide frequency range and, thus, the power is spread out over all frequencies. As mentioned briefly above, from the standpoint of patient response variability, such waveform characteristics are preferable for ***microcurrent*** stimulation therapy, and in particular, macular degeneration therapy.

Referring now to FIGS. 4a-4d, a method for treating visual system diseases, and in particular, a method for treating macular degeneration will be described. Specifically, to treat macular degeneration, a ***microcurrent*** stimulation therapy device, using a swept digital or pulsed signal, similar to the embodiments described above, is used. As mentioned above, in order to create a closed circuit for the ***microcurrent*** stimulation device, a brass cylinder or rod preferably is held in one hand of the patient, and a brass ***microcurrent*** stimulation probe with a shielded handle is applied to the patient by the therapist. The brass cylinder or rod conducts the electric current allowing the current to pass through the particular body part for therapy.

In accordance with one embodiment of the present invention, each eye that shows signs of macular degeneration is treated by providing a ***microcurrent*** through four points on the upper and four points on the lower eyelid for a total of eight points around the eye. FIG. 4a illustrates the eight points around the eye which are stimulated and the preferred order of stimulation. For example, the stimulation preferably occurs in the order from point one to point eight. When stimulating the eyelid, the patient preferably looks away from the probe with eyes closed. This rolls the macula closer to the stimulation point, keeping the ***microcurrent*** from passing through dense eye structures, such as lens, iris and ciliany body, resulting in better ***microcurrent*** penetration into the macula region. The eight points around the eye are stimulated using a current between about 50 to about 350 microamps, and more preferably between about 150 and 250 microamps. In accordance with one preferred embodiment of the present invention, the current applied to the eyelid is brought up until the patient sees light flashes and/or feels the tinge of electricity. The current is then decreased so that the patient feels no discomfort. This is the preferred current level used for the therapy.

In accordance with a preferred embodiment of the present invention, each point around the eye is stimulated for about 8 to about 60 seconds, and more preferably for about 30 seconds, using a sweep wave signal. As discussed above, the sweep wave signal may comprise one swept signal, or two independent sweep wave signals combined by an adder/buffer circuit. In accordance with this aspect of the present invention, one of the sweep wave signals preferably comprises a rectangular sweep wave signal having a peak-to-peak voltage of between about 10 to about 30 volts, and more preferably about 20 volts. In addition, the square or rectangular sweep wave signal preferably has a sweep wave frequency range of about 0 to about 400 Hz, and more preferably of about 0 to about 35 Hz; has a sweep time of between about 7 and about 60 seconds, and more preferably of about 15 seconds; and has a duty cycle of between about 20 and about 95 percent, and more preferably of about 75 percent. The other signal generator preferably provides a sweep wave signal having a lower peak-to-peak voltage than the first sweep wave signal. For example, the second sweep wave signal preferably has a peak-to-peak voltage of between about 0.1 to about 4 volts and more preferably about 1 volt, if needed. In addition, the second sweep wave signal preferably has a sweep wave frequency range of about 500 to about 2 MHz, and more preferably of about 500 to about 1.5 MHz; and a sweep time of between about 7 and about 60 seconds, and more preferably of about 15 seconds. The second sweep wave signal may comprise a sinusoidal waveform, a square waveform, a triangular waveform, a ramp waveform, a step waveform, or the like.

In accordance with another preferred embodiment of the present invention, the second signal comprises a non-swept or fixed frequency signal, rather than a swept or sweep wave signal. In accordance with this aspect of the invention, the non-swept wave signal may comprise a sinusoidal wave, a square or rectangular wave, a ramp wave, a step wave, or the like. Preferably, the non-swept wave signal has a peak or peak-to-peak voltage of between about 0.1 to about 4 volts, and more preferably about 1 volt. In addition, the fixed frequency of the non-swept wave signal preferably is in the range of about 500 Hz to 2 MHz, and more preferably in the range of about 500 Hz to 1.5 MHz.

In addition to stimulating points around the eye, the method for treating macular degeneration may include treating other acupuncture or pressure points on the body. For example, as shown in FIG. 4a, there are 2 points, A and B, on the forehead which can be used for ***microcurrent*** stimulation. In accordance with this aspect of the present invention, two probes preferably are attached to the frontal area of the forehead at points A and B, and a microcurrcnt scan is applied to these points for about 10 to 20 minutes, and more preferably for about 15 minutes. In this manner, a relaxation mode of the therapy procedure is applied to the patient. That is, by attaching the electrodes to the forehead of the patient and applying a ***microcurrent*** to that location, the conductance of electricity in the head area is increased, thus helping relax the patient, as well as providing other therapeutic affects. For example, in this relaxation mode, some of the ***microcurrent*** is scattered toward the eye region, thus supplying additional ***microcurrent*** therapy to the eyes.

In addition, as illustrated in FIG. 4b, there are eight acupuncture or pressure points on the back of the neck which may be stimulated during macular degeneration therapy. In accordance with this aspect of the invention, each pressure point 1-8 is stimulated in ascending order for about 20 to about 60 seconds. Similarly, FIG. 4c shows 10 acupuncture or pressure points on the ear which also may be stimulated for macular degeneration therapy. As with the points around the eye and on the back of the neck, each point 1-10 on the ear is stimulated in ascending order for about 10 to about 30 seconds. Finally, FIG. 4d illustrates four pressure points on an arm

which also may be stimulated in the same manner as with the eyes, neck and ears. In accordance with a preferred embodiment of the present invention, similar waveforms are used on the eyes, neck, ears and arms. However, in accordance with other preferred embodiments of the invention, different waveforms may be used on the different body parts, depending on the therapeutic effect of a particular waveform at a particular location.

In accordance with a preferred method for treating macular degeneration, patients initially are treated twice a day for 4 days and 3 times a week thereafter.

With reference to FIG. 9, an embodiment which digitally controls the modulation frequency is shown in block diagram form. This embodiment includes a controller 200, a read only memory (ROM) 204, a digital-to-analog converter (DAC) 208, a voltage controlled oscillator (VCO) 212, a voltage limiter circuit 214, a current level indicator 216, a data acquisition module 224, and a current sensor and limiter circuit 228. These components allow digital frequency modulation (FM) of the output signal produced by the ***microcurrent*** stimulation therapy apparatus 232. In other embodiments, an analog waveform generator could also be used in place of parts 200, 204 and 208.

The controller 200 reads values from a lookup table in the ROM 204 to produce a digital word for the DAC 208. The DAC 208 converts a digital word into an analog voltage which is then coupled to the VCO 212. The analog voltage frequency modulates the oscillation of the VCO 212 to produce a modulated frequency. To modify the level of the signal under control from the user, the modulated output from the VCO 212 passes through the voltage limiter circuit 214. The voltage control may be provided by a potentiometer, or other known method.

Monitoring and regulating of the current applied to the patient is performed with a current sensor and limiter circuit 228. The current sensor and limiter circuit 228 regulates the signal to a level selected by the user by using a potentiometer, or the like which is coupled to the current control input. Additionally, the current sensor and limiter circuit 228 passes the signal through a resister so that the current can be sensed as it varies the voltage drop across the resister. To allow application to a patient, the output from the current sensor and limiter circuit 228 is coupled to a probe tip. In this way, the controller can digitally modulate a signal frequency applied to the patient.

The current level indicator 216 displays the current level sensed from the signal and feeds this information to the data acquisition module 224. The indicator 216 can have both visual and audio outputs. For example, it may be a series of LEDs which light up in succession according to the current level. Furthermore, the current level indicator 216 can utilize digital and analog techniques to show the patient the present current applied.

The current measured by the current level indicator 216 is passed to the data acquisition module 224. Additionally, the data acquisition module 224 can record the applied voltage over time so that both current and voltage is known. The physician can download the information from the data acquisition module 224 to analyze the output signal applied to the patient. In other embodiments, the current

information could be fed back to the controller such that closed loop feedback could more precisely adjust the output current.

The lookup table within the ROM 204 can store any number of frequency sequences. Additionally, the controller can repeat the entries of the lookup table in a loop to conserve room. Each digital word read from the ROM 204 corresponds to an analog voltage. The analog voltage is applied to the VCO 212 to produce a predetermined modulation frequency. The ROM 204 is preferably a non-volatile and reprogrammable memory device such as an EPROM, an EEPROM, a FLASH memory, or the like. Depending upon the treatment regiment specified, the lookup table within the ROM can be modified by the patient's physician. In this way, any number of frequency sequences can be produced by the therapy apparatus 232.

The digital modulation of the ***microcurrent*** stimulation therapy apparatus 232 can provide precision in controlling the spectral response of the signal applied to the patient. Over time, the spectral response exhibits specific frequency components which corresponded to the various frequencies produced by the VCO 212. As described above, the frequency produced by the VCO 212 is achieved from a digital data word stored in a lookup table in the ROM 204. In a non-linear manner, the frequency components from the lookup table could be distributed over the spectrum. The lookup table could sweep the frequency through the spectrum or achieve any different frequency at any time. Therapies for different types of medical conditions my require a more complex spectral response than merely sweeping the frequency from one end of the spectrum to the other. The digital frequency modulation technique could, for example, sweep from 2 KHz through 4 KHz and then sweep from 7 KHz to 9 KHz. To conserve space in the ROM 204, the controller 200 could repeat the delivery of digital data words in a loop to continually repeat the frequency modulation sequence. The wide variety of possible spectral responses allows the therapy apparatus 232 to provide a response that is useful in the treatment of many different health problems such as diseases of the visual system (including macular degeneration and retinitis pigmentosa), orthopedic problems (including sciatica), pain and fatigue disorders (including myofascial pain syndrome, fibromyalgia, sciatica, and neuralgia), and perhaps certain types of ***cancer*** (including retinoblastoma cells).

The ***microcurrent*** stimulation therapy apparatus 232 can achieve small electronically controlled frequency variations where the change in frequency over time is automatic. This provides the capability to treat a patient with a wider range of frequencies and frequency combinations. As mention above, the waveforms could be unipolar, bipolar or bi-phasic. Unipolar waveforms are characterized by being always positive or always negative; bipolar waveforms are characterized by being both positive and negative, but not necessarily symmetric about the zero potential axis; and bi-phasic waveforms are characterized by being symmetric about the zero potential axis.

This embodiment utilizes frequency modulation (FM), to provide a frequency swept output waveform which distributes the specific frequency components over time. Other embodiments with analog swept sinusoidal output signals which distribute the frequency over time produce a continuous spectral density function. However, in the case of swept digital or pulse waveforms, the spectral density function will also exhibit specific frequency components distributed over time. Accordingly, the spectral density function may also exhibit discrete properties. Digital frequency sweep techniques include (but are not limited to) voltage/current control of an oscillator, programmable frequency division of a oscillating signal and table look-up of the frequency. For example, a programmable number of

flip flops could divide a source frequency into any number of lower frequencies. Unlike prior art electro therapeutic systems that require manual frequency changes or small electronically controlled frequency variations, the change in frequency of this embodiment over time is automatic, providing the capability to treat the patient with a wider range of frequencies and frequency combinations.

With reference to FIG. 10, a ***microcurrent*** stimulation therapy apparatus 332, which directly synthesizes the output waveform without using the above described digital modulation technique, is shown in block diagram form. Direct synthesis is the process by which a waveform is recreated by a controller 200 using values from a ROM 204 to control a signal source 336. In the embodiment depicted in FIG. 9, a VCO would not be required and the signal source 208 feeds directly to the current sensor and limiter 228. In this embodiment, the ROM 204 contains a look-up table providing an output to the controller 200 that controls the voltage level of the output signal from the signal source 208. The digital words are reformatted, if necessary, and coupled to the signal source 336. The signal source 208 creates a voltage which corresponds to the digital word.

In essence, the signal source 208 functions as a digital to analog converter in this embodiment. The waveform output from the signal source 208 is comprised of constituent voltage levels which over time create a signal of a single frequency or multiple frequencies. Each constituent voltage corresponds to a digital word from the ROM 204. By using this direct digital synthesis technique, the signal could have any number of predetermined shapes. As can be appreciated by those skilled in the art, use direct digital synthesis allows producing complex waveforms with many constituent frequency components.

To conserve storage space in the ROM 204, only the waveform for a single period need be stored. The controller 200, being aware of the periodic nature of the waveform, could feed the period of the waveform in a continuous loop to recreate the periodic nature of the waveform. A simple example of this is a period which is comprised of a data word of all zeros and a data word of all ones. When fed to the DAC 208 in a loop, the data words would create an oscillating square wave with a period of twice the sampling period of the signal source 336. In this way, waveforms of any shape can be directly digitally synthesized.

Other variations of the circuit in FIG. 10 are also possible. In another embodiment, the controller 200 reads a value from the ROM 204 to produce a voltage. The voltage is coupled to the signal source 336 where the voltage is used to select a oscillation frequency. As the voltage varies, so does the oscillation frequency, such that a range of frequencies is possible as proscribed by the ROM 204. In this embodiment, the signal source 336 performs as a voltage controlled oscillator where the voltage which corresponds to the digital word selects the output frequency. However, it is noted a current could also be used to control the signal source 336.

In yet another embodiment, the controller 200 reads a value from the ROM 204 which corresponds to a pulse. The pulse is created by the controller 200 and fed to the signal source 336. The signal source uses the pulse to select a frequency to generate. By varying the pulse, any number of frequencies are selected.

With reference to FIGS. 11 and 12, embodiments of a triangular waveform and a ramp waveform are respectively shown. Voltage is shown in the ordinate direction and time is shown along the abscissa.

Referring next to FIGS. 13A and 13B, embodiments of bi-phasic pulses are shown. More specifically, FIG. 13A shows a bipolar return-to-zero pulse waveform, and FIG. 13B shows a Manchester code pulse waveform. Voltage is shown in the ordinate direction and time is shown along the abscissa. Bi-phasic pulse waveforms have pulses that have a positive and negative polarity and arc not necessarily symmetrical with respect to positive and negative polarity.

In conclusion, the present invention provides novel methods and apparatus for using ***microcurrent*** stimulation therapy to treat various physiological problems, such as pain, wounds and visual eye diseases. While a detailed description of presently preferred embodiments of the invention have been given above, various alternatives, modifications, and equivalents will be apparent to those skilled in the art. For example, while a particular circuit configuration is given for a sweep wave signal generator of the present invention, various other circuit configurations may be used; such as, digital signal processing circuits or digitally generated wave signal circuits. In addition, while one preferred method for treating macular degeneration is disclosed, other suitable methods may be used to treat macular degeneration, other eye diseases or other chronic problems such as pain and persistent sores. Thus, any number of sweep signal generator circuits and therapy methods may be used without varying from the spirit of the invention. Therefore, the above description should not be taken as limiting the scope of the invention which is defined by the appended claims.

Apparatus and method for toning tissue with a focused, coherent electromagnetic field (pgs 173-187)

United States Patent **6,155,966**

Parker **December 5, 2000**

Abstract

An apparatus and method for toning tissue and particularly skin with a focused, coherent electromagnetic field employ a housing, a user-accessible switch positioned on the housing, and electronics and an electromagnet assembly positioned within the housing. The electromagnet assembly includes a static magnet and an electromagnet which are assembled relative to each other and positioned within the housing such that negative magnetic poles of the static magnet and the electromagnet both face outwardly from an end portion of the housing. The electronics provide a periodic current depending upon a setting of the switch. The electromagnet assembly generates a focused, coherent electromagnetic field in response to the periodic current.

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Claims

I claim:

1. An apparatus for toning tissue with a focused, coherent electromagnetic field, the apparatus comprising:

a housing shaped to be hand-held and including an end portion;

a user-accessible switch positioned on said housing, said switch being manipulable into a plurality of switch settings;

electronics secured within said housing and adapted to provide a source of periodic current pulses at one of a plurality of pulse rates depending upon which of said switch settings is selected; and

an electromagnet assembly electrically connected to said electronics and fitted within said housing, said electromagnet assembly including an electromagnet positioned adjacent to said end portion and oriented such that a negative magnetic pole of said electromagnet faces outwardly from said housing, said electromagnet assembly including a static magnet oriented such that a negative magnetic pole of said static magnet is directed toward said end portion, said electromagnet assembly generating a focused, coherent electromagnetic field in response to the current pulses, the field having an intensity no greater than 500 milliGauss.

2. An apparatus for toning tissue with a focused, coherent electromagnetic field, the apparatus comprising:

a housing;

electronics secured within said housing and adapted to provide a current; and

an electromagnet assembly electrically connected to said electronics and fitted within said housing, said electromagnet assembly includes a static magnet and an electromagnet oriented such that negative magnetic poles of said static magnet and said electromagnet face a common direction, said electromagnet assembly generating a focused, coherent electromagnetic field in response to the current, the field having an intensity no greater than 500 milliGauss.

3. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein:

said negative magnetic poles of said static magnet and said electromagnet are aligned along a common axis.

4. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein:

said housing includes an end portion; and

said electromagnet is positioned adjacent to said end portion and oriented such that a negative magnetic pole of said electromagnet faces outwardly from said housing.

5. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein:

said housing includes an end portion; and

said static magnet is oriented such that a negative magnetic pole of said static magnet is directed toward said end portion.

6. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein the current is a spiked pulse train.

7. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein the current is a square pulse train.

8. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein the current is unipolar.

9. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein the current is periodic.

10. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 9 wherein:

said electronics are adapted to generate the current at a plurality of pulse rates.

11. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 9 wherein:

said electronics are adapted to generate the current at a plurality of pulse widths.

12. The apparatus for toning tissue with a focused, coherent electromagnetic field of claim 2 wherein:

said housing comprises an electric shaver housing.

13. A method for toning tissue with a focused, coherent electromagnetic field, the apparatus comprising the steps of:

(a) employing an electromagnet assembly to generate a focused, coherent electromagnetic field having an intensity no greater than 500 milliGauss, said electromagnetic assembly including a static magnet and an electromagnet oriented such that negative magnetic poles of said static magnet and said electromagnet face a common direction; and

(b) positioning the electromagnet assembly relative to a surface of a tissue such that a current is induced in the tissue.

14. The method for toning tissue with a focused, coherent electromagnetic field of claim 13 wherein:

said step (b) further comprises moving the electromagnet assembly over an area of the tissue.

15. The method for toning tissue with a focused, coherent electromagnetic field of claim 13 wherein:

the electromagnet assembly is adapted to generate one of a plurality of pulsed magnetic fields each with a different pulse rate; and

said step (b) further comprises positioning the electromagnet assembly relative to the surface for a predetermined length of time depending upon which of the pulsed magnetic fields is being generated by the electromagnet assembly.

16. The method for toning tissue with a focused, coherent electromagnetic field of claim 13 wherein:

the electromagnetic field is a pulsed field with a pulse rate selected to stimulate nerves in the tissue.

17. The method for toning tissue with a focused, coherent electromagnetic field of claim 13 wherein:

the electromagnetic field is a pulsed field with a pulse rate less than 50 pulses per second.

18. The method for toning tissue with a focused, coherent electromagnetic field of claim 13 wherein:

the electromagnetic field is a pulsed field with a pulse rate between 6 and 25 pulses per second.

19. The method for toning tissue with a focused, coherent electromagnetic field of claim 13 wherein:

the electromagnetic field is a pulsed field with a pulse rate selected to stimulate a flow of blood in the tissue.

20. The method for toning tissue with a focused, coherent electromagnetic field of claim 13 wherein:

the electromagnetic field is a pulsed field with a pulse rate no greater than 150 pulses per second.

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus and method for toning tissue and, more particularly, pertains to an apparatus and method for toning skin with a focused, coherent electromagnetic field.

2. Description of the Related Art

Since the dawn of the mirror, man has sought ways to conceal, slow, and even **reverse the signs of aging.** As a result of the aging process, the tone and other characteristics of the skin change. Wrinkles in the skin, sagging and dryness are but a few symptoms and, unfortunately, these imperfections are particularly visible on the face which is almost always exposed.

Prior attempts to eliminate the signs of aging having involved a variety of products and procedures including makeup and face creams, chemical peels, and, more drastically, facial surgery. While makeup and creams may conceal or temporarily soften skin defects and, in some instances, provide nutrients to the skin, they do not address the fundamental problem of a deterioration in the tone of the skin. Chemical peels and facial surgery do nothing to directly address the problem of skin tone deterioration with age. Furthermore, these procedures are expensive, undesirable to many people, and sometimes accompanied with negative side effects. Clearly, there is a need

for a safe, affordable and nonevasive method for improving the tone of skin.

Magnets and devices adapted to generate controlled magnetic fields have been used in many different medical applications. For example, magnetic resonance imaging (MRI) is replacing x-ray diagnosis because it is safer and more accurate, and magnetoencephalography is now replacing electoencephalography as the technique of choice for recording ***electrical*** activity of the brain. **Magnetic field therapy has also been used in the treatment of *cancer,* rheumatoid disease, infections and inflammations, headaches and migraines, insomnia and sleep disorders, and other ailments. However, there is no known apparatus or method for toning skin with a focused, coherent electromagnetic field.**

OBJECTS AND SUMMARY OF THE INVENTION

Thus, it is an object of the present invention to provide an apparatus or method for toning tissue with a focused, coherent electromagnetic field.

In accordance with a specific illustrative embodiment of the present invention, an apparatus for toning tissue with a focused, coherent electromagnetic field includes a housing, a user-accessible switch positioned on the housing, electronics secured within the housing, and an electromagnet assembly. The housing is shaped to be hand-held and includes an end portion. The switch is manipulable into a plurality of switch settings. The electronics are adapted to provide a source of periodic current pulses at one of a plurality of pulse rates depending upon which of the switch settings is selected. The electromagnet assembly is electrically connected to the electronics and fitted within the housing. The electromagnet assembly includes an electromagnet positioned adjacent to the end portion and oriented such that a negative magnetic pole of the electromagnet faces outwardly from the housing. The electromagnet assembly includes a static magnet oriented such that a negative magnetic pole of the static magnet is directed toward the end portion. The electromagnet assembly generates a focused, coherent electromagnetic field in response to the current pulses.

In another aspect of the present invention, an apparatus for toning tissue with a focused, coherent electromagnetic field includes: a housing; electronics secured within the housing and adapted to provide a current; and an electromagnet assembly electrically connected to the electronics and fitted within the housing, the electromagnet assembly including a static magnet and an electromagnet oriented such that negative magnetic poles of the static magnet and the electromagnet face a common direction, the electromagnet assembly generating a focused, coherent electromagnetic field in response to the current.

In another aspect of the present invention, a method for toning tissue with a focused, coherent electromagnetic field includes the steps of: employing an electromagnet assembly to generate a focused, coherent electromagnetic field, the electromagnetic assembly including a static magnet and an electromagnet oriented such that negative magnetic poles of the static magnet and the electromagnet face a common direction; and positioning the electromagnet assembly relative to a surface of a tissue such that a current is induced in the tissue. Furthermore, the positioning of the electromagnet assembly may include moving the electromagnetic assembly over an area of the tissue to be treated.

The electromagnet assembly employed in the method for toning tissue is adapted in a further aspect of the present invention to generate one of a plurality of pulsed magnetic fields each with a different pulse rate, and the step of positioning the electromagnet assembly further includes positioning the electromagnet assembly relative to the surface of the tissue for a predetermined length of time depending upon which of the pulsed magnetic fields is being generated by the electromagnet assembly.

DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention will become readily apparent upon reference to the following detailed description when considered in conjunction with the accompanying drawings, in which like reference numerals designate like parts throughout the figures thereof, and wherein:

FIG. 1 is a front view of an exemplary preferred embodiment of an apparatus for toning tissue with a focused, coherent electromagnetic field according to the present invention;

FIG. 2 is a side view of the apparatus for toning tissue of FIG. 1;

FIG. 3 is a perspective view of an electromagnetic assembly of the apparatus for toning tissue of FIG. 1;

FIG. 4 is an ***electrical*** schematic of electronics of the apparatus for toning tissue of FIG. 1;

FIG. 5 is a timeline showing a square pulse train provided to the electromagnetic assembly of FIG. 3; and

FIG. 6 is a timeline showing a spiked pulse train provided to the electromagnetic assembly of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1, an exemplary, preferred apparatus 20 for toning tissue with a focused, coherent electromagnetic field includes a housing 22 with an end portion 24. An electromagnetic assembly is fitted within the end portion 24. Preferably, the housing 22 and the end portion 24 are formed of a moldable, plastic material.

Generally, the electromagnetic assembly produces a focused, coherent electromagnetic field which, in conjunction with movement of the apparatus 20 across the tissue, e.g., skin, induces a flow of ***microcurrent*** through the tissue from the surface. Therefore, the housing 22 is preferably sized and shaped in view of ergonomic considerations such as a desire to provide an apparatus that is comfortable to hold in the hand of a typical intended user. To this end, the illustrated exemplary housing 22 includes an indented portion 26 sized and positioned to receive a finger or fingers of the user to facilitate better gripping of the toning apparatus 20. A

sliding, multi-position switch 28 is positioned on the outside of the housing 22 so that it is easily manipulated by the thumb. The switch 28 is electrically connected to electronics within the housing which provide an input current to the electromagnetic assembly as discussed in greater detail with reference to FIGS. 3 and 4. A removable panel 30, e.g., a plastic snap-fit panel, provides access to a battery within the housing 22 that provides power to the electronics.

Referring to FIG. 2, the preferred toning apparatus 20 also includes a pad 32 attached to the housing 22 and positioned as shown. An exemplary pad 32 comprises a rubber pad formed with a textured surface which makes it easier to grip the apparatus 20 particularly when the hands of the user are wet. A preferred housing 22 is waterproof to prevent damage to the electronics positioned therein and any possibility of ***electrical*** shock to the user. It should be understood that the scope of the present invention additionally encompasses a toning apparatus 20 that includes an electric shaver mechanism, vibration unit, and/or a heating element in or adjacent to the end portion 24.

FIG. 3 is a perspective view of an electromagnetic assembly 40 of the toning apparatus 20. The electromagnetic assembly 40 is electrically connected to the electronics within the housing 22 and includes a static magnet 42 and an electromagnet 44. The electromagnet 44 is positioned adjacent to the end portion 24 and oriented such that a negative pole of the electromagnet 44 faces outwardly from the housing 22. The static magnet 42 provides a baseline field and is oriented such that a negative pole of the static magnet 42 is also directed toward the end portion 24 of the housing 22. Preferably, the static magnet 42 and the electromagnet 44 are oriented such that their negative poles face a common direction, directed outwardly from the end portion 24 of the housing 22, along a common axis.

An exemplary electromagnet 44 includes a core with a conventional solid center 46 and a surrounding high-permeability material 48 to maximize inductance and reduce size. Inductance is preferably no less than 3.5 Henry. The center 46 has a cylindrically-shaped outer surface about which a coil is wrapped. The high-permeability material 48 is shaped as a cylinder with its inner surface circumferentially positioned relative to the outer surface of the core center 46. The electromagnet 44 also includes ***electrical*** leads 50, 52 which are part of the coil. The electronics provide a current to the electromagnet 44 via the ***electrical*** leads 50, 52. The current should not exceed 50 mA with peaks of 100 mA. The electromagnet 44 also includes field directors 54, 56 attached at opposing sides of the core as shown. Exemplary field directors 54, 56 are comprised of iron or steel. Preferably, the outside diameter of the high-permeability material 48 is approximately equal to the height of the field directors 54, 56. The static magnet 42 comprises, for example, a toroid permanent magnet or ceramic round or bar magnet which is slightly larger than the outer diameter of the core. The electromagnetic assembly 40 also includes a cover (not shown) secured over the core.

In order to direct the negative poles of the static magnet 42 and the electromagnet 44 outwardly from the end portion 24, the electromagnetic assembly 40 is positioned within the housing 22 adjacent to the end portion 24 and oriented such that an outer surface 58 of the electromagnet 44 faces outwardly from the end portion 24.

A key aspect of the present invention is that the toning apparatus 20 generates a "focused" field. The field generated by the toning

apparatus 20 is "focused" because the inductor coil is positioned in front of the static magnet 42. Although this configuration is preferred, it is contemplated that the static magnet 42 could alternatively be positioned in front of the inductor coil.

Another key aspect of the present invention is that the toning apparatus 20 generates a "coherent" field. More specifically, the preferred toning apparatus 20 generates a unipolar, negative polarity only field.

FIG. 4 shows electronics 60 of the toning apparatus 20 which are secured within the housing 22 and adapted to provide a current to the electromagnet assembly 40 via leads 50, 52. The electronics 60 are designed to control the current such that the electromagnetic assembly 40 generates a unipolar, negative polarity only field in response to the current. The unipolar, negative polarity nature of the field is important because it has been observed that microcurrents induced in the tissue have a different effect depending upon the polarity of the inducing field. The amount of flux employed and pulse rate also influence how the tissue reacts to the microcurrents induced therein. At higher pulse rates (above 50 pulses per second), muscle fatigue can result when the nerves in the tissue are pulsed.

A positive pole tends to increase blood flow in tissue, particularly skin. So does a negative pole, but to a lesser extent. However, a negative pole also repels water molecules which are charged negatively and attracts oxygen, hemoglobin, and antioxidants which are charged positively. Since oxygen reduction causes wrinkles, as is evidenced by the fact that the skin of smokers often appears to age faster than non-smokers, a negative pole configuration improves the tone of the skin by counteracting oxygen reduction. Furthermore, the attraction of blood to the skin adds color to the complexion.

When a lower pulse rate (below 50 pulses per second) and a negative pole are used, toning results after a few minutes of use, while avoiding the muscle fatigue caused by higher pulse rates. It has been observed that a slight swelling may result if the apparatus 20 is used for more than approximately 10 minutes even with a lower pulse rate.

Another key aspect of the present invention is that the induced microcurrents stimulate the muscles in the effected area by stimulating the nerves leading to these muscles. In fact, application of the toning apparatus 20 increases muscle tone in the effected area, improves connection of the nerves to these muscles (which often deteriorate with age), and improves nerve conduction. Other observed benefits provided by the present invention include: accelerated turnover of skin cells resulting in younger appearing skin, reduction in pore size, increased oil secretions resulting in reduced skin dryness, increased protein synthesis, and accelerated healing of the skin.

Referring again to FIG. 4, the illustrated exemplary electronics 60 include resistors 62, 64, 66, a capacitor 68, a silicon controlled rectifier (SCR) 70, a power source 72, and the power and rate switch 28 configured as shown. The electronics 60 provide a source of periodic current spikes or pulses at one of a plurality of rates depending upon the position of the switch 28. The resistors 62 and 64 are selected depending upon the pulse rates desired for each switch setting. FIGS. 5 and 6 respectively show spiked and square pulse trains of current which are provided by the electronics 60 to the electromagnet assembly 40 depending upon the selection of circuit elements and the particular configuration of the electronics 60. It should be understood that the electronics 60 in FIG. 4 can be modified in a variety of ways such as by providing a pulse generator for generating the square pulse train, providing for pulse width

adjustability, etc. Alternating current (AC) can also be provided.

In an exemplary preferred embodiment, the toning apparatus 20 is configured to operate in at least two different modes. An exemplary "immediate toning" mode of operation employs a pulse rate between 6 and 25 pulses per second and can be performed daily for approximately 2 minutes. This mode of operation causes the muscles to contract by stimulating the nerves and repels water which reduces puffiness. A "long-term toning" mode of operation employs a pulse rate of up to 150 pulses per second and, for example, is performed for 10-20 minutes, every 3 days, for 3-6 weeks, and then for 10 minutes, 1 or 2 times per week thereafter. This mode of operation increases blood flow and results in a longer-term toning of the skin.

For both modes of operation, the toning apparatus 20 is moved against the tissue surface covering the entire area to be effected at a rate of movement approximately 1-3 times the rate of movement of a razor during shaving. The static magnet 42, which focuses the field generated by the electromagnet 44, itself induces current in the tissue as a result of its movement throughout the earth's magnetic field. Thus, the static magnet 42 provides a substantially continuous current corresponding to a substantially continuous, e.g., circular, movement of the toning apparatus 20 over the tissue by the user. Preferably, the flux intensity of the field incident upon the area being effected does not exceed 500 milliGauss.

It is also noted that better results may be obtained by increasing skin nourishment (Vitamin A, Vitamin C, Vitamin E, Magnesium, Selenium, grape seed extract) and further increasing skin turnover with alpha hydroxy acids and with retinol, which increases elasticity, or collagen. A liquid toner or salicylic acid can also be used as an adjunct between applications.

Those skilled in the art will appreciate that various adaptations and modifications of the just described preferred embodiment can be configured without departing from the scope and spirit of the invention. For example, the electronics 60 can be modified to provide a "burst mode", e.g., ten bursts in a row with a pulse width of 250 microseconds. Furthermore, it is contemplated that the housing 22 of the toning apparatus 20 can take many forms. For example, the housing 22 can comprise of pair of eyeglasses with two electromagnet assemblies 40 positioned respectively in the arms of the eyeglasses adjacent the skin near the corners of the eyes, a regional mask to cover the face, neck, hands or stomach, or a bed to affect the entire body. Furthermore, the issues effected by the toning apparatus 20 are not limited to skin on the face. For example, the toning apparatus 20 is also suitable for toning muscles of the vagina. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described herein.

System and method for treating cells using electromagnetic-based radiation (pgs 187-200)

United States Patent **6,235,251**
Davidson **May 22, 2001**

Abstract

A device for treating cells is disclosed. The device includes a plurality of permanent magnets arranged in a side-by-side relationship with the magnetic north pole and the magnetic south pole of each permanent magnet being adjacent the magnetic north pole and magnetic south pole of an adjacent permanent magnet, respectively, the plurality of permanent magnets forming a ring of permanent magnets. The device further includes an electrically conductive wire wound substantially around the ring of permanent magnets, and tubing wrapped around the ring of permanent magnets between windings of the wire. A cooling device introduces a flow of coolant through the tubing so as to substantially cool the device. The device further includes a control circuit, connected to the wire, for selectively generating a coil current for passing through the wire. The current has an AC component and a DC component. The frequency of the AC component is programmable and is set to substantially match a resonant frequency associated with the cells to be treated. The coil current creates an electromagnetic field that interacts with a magnetic field generated by the ring of permanent magnets to generate a complex field that causes ionic collisions within the cells to be treated.

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Claims

What is claimed is:

1. A frequency generator for treating cells of a similar type, comprising:

a plurality of permanent magnets arranged in a side-by-side relationship with the magnetic north pole and the magnetic south pole of each permanent magnet being adjacent the magnetic north pole and magnetic south pole of an adjacent permanent magnet, respectively, the plurality of permanent magnets forming a ring of permanent magnets;

a wire of electrically conductive material wound substantially around the ring of permanent magnets so as to form a coil;

tubing wrapped around the ring of permanent magnets between windings of the wire;

a cooling device for introducing a flow of coolant through the tubing; and

a control circuit, connected to the wire, for selectively generating a coil current for passing through the wire, the current having an AC

component and a DC component, the AC component having a frequency that is programmable to substantially match a resonant frequency of the cells to be treated, the coil current creating an electromagnetic field which interacts with a magnetic field generated by the ring of permanent magnets so as to generate a complex field that is applied to the cells to be treated.

2. The frequency generator of claim 1, wherein:

the control circuit includes a frequency changer circuit for generating the AC component of the coil current, the frequency changer circuit being controlled to generate the AC component having a frequency which substantially matches the resonant frequency of the cells to be treated.

3. The frequency generator of claim 1, wherein:

the control circuit includes a rectifier circuit for receiving an AC supply signal and generating a DC component of the coil current.

4. The frequency generator of claim 3, wherein:

the rectifier circuit is selectively controlled to generate the DC component having a desired current level.

5. The frequency generator of claim 4, wherein

the control circuit includes a switching circuit for selectively reversing the polarity of the DC component of the coil current.

6. The frequency generator of claim 1, further comprising:

a frame for housing the ring of permanent magnets, the wire and the tubing.

7. The frequency generator of claim 6, further comprising:

a lid member removably attached to and cooperating with the frame for enclosing the ring of permanent magnets, the wire and the tubing.

8. The frequency generator of claim 7, wherein:

the lid member and the frame define an amount of air space therewithin.

9. The frequency generator of claim 8, wherein:

the frame includes one or more air ducts disposed along the frame in fluid communication with the air space within the frame and the lid.

10. The frequency generator of claim 1, wherein:

the ring of permanent magnets includes at least one gap between two adjacent permanent magnets.

11. The frequency generator of claim 1, wherein:

the cooling device comprises a condenser unit and a pump unit in fluid communication with the tubing.

12. The frequency generator of claim 1, wherein:

the tubing is copper tubing.

13. The frequency generator of claim 1, further comprising:

a second wire wrapped around the ring of permanent magnets and connected to the control circuit for passing the coil current through the second wire.