The Science of PEMF

Dr. Garry F. Gordon MD,DO,MD(H)
Gordon Research Institute

SATURDAY, OCTOBER 27, 2012

The Woodland of Van Buren
Wayne, Michigan

GRI-e

M.I.C.E.

F.A.C.T.
Forum on Anti-Aging & Chelation Therapies

LONGEVITY PLUS
Anti-Aging Products

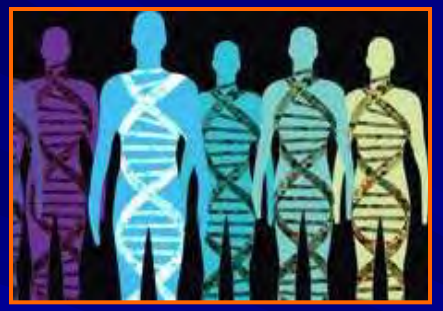
FUNCTIONAL MEDICINE

Predictive, Preventive, Personalized, and Participatory

Functional medicine is the future of conventional medicine–available now. It seeks to identify and address the root causes of disease, and views the body as one integrated system, not a collection of independent organs divided up by medical specialties. It treats the whole system, not just the symptoms.

DNA/Telomerase Testing

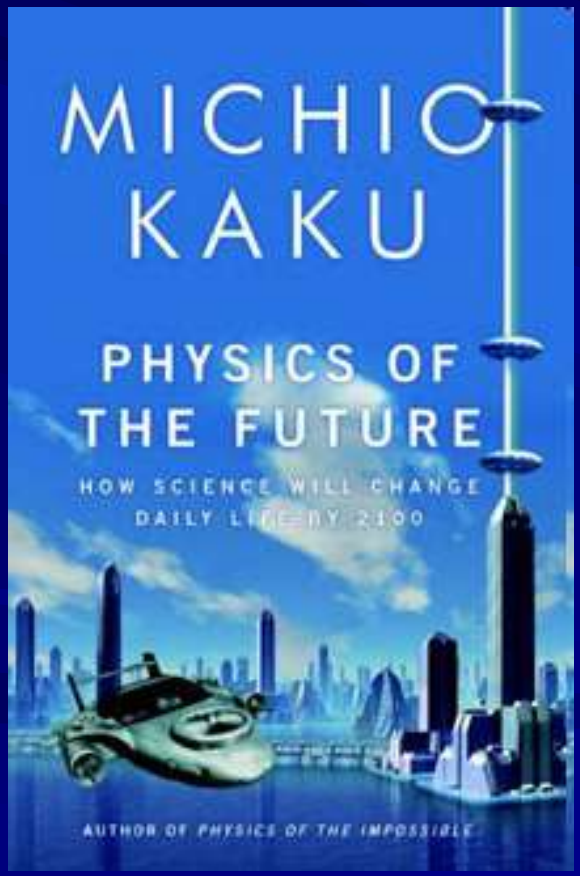
Diet & Lifestyle Modification



Personalized Therapies

Community Group Support

Intensive lifestyle therapy—not just wellness counseling or prevention, but lifestyle treatment of existing chronic disease—focusing on pre-diabetes, diabetes, and heart disease has been proven to work better than medication or surgery.



Based on interviews with over three hundred of the world's top scientists, who are already inventing the future in their labs, Kaku—in a lucid and engaging fashion—presents the revolutionary developments in medicine, computers, quantum physics, and space travel that will forever change our way of life and alter the course of civilization itself.

Dr. Kaku's astonishing revelations include:

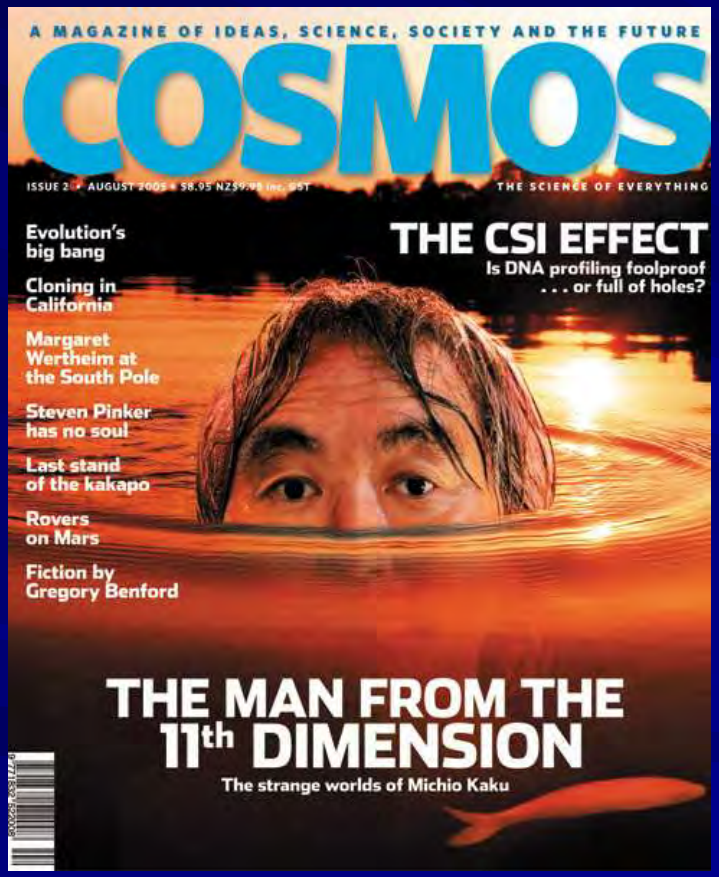
Sensors in your clothing, bathroom, and appliances will monitor your vitals, and nanobots will scan your DNA and cells for signs of danger, allowing life expectancy to increase dramatically.

You will control computers and appliances via tiny sensors that pick up your brain scans.

http://mkaku.org/home/?p=988

THE MAN FROM THE 11TH DIMENSION *By Elizabeth Finkel*

His mind wanders incredibly complex worlds of eleven dimensions and he is trying to complete Einstein's unfinished masterpiece: a 'theory of everything'. Meet one of the world's leading theoretical physicists, Michio Kaku, a founder of string field theory and a man as charming as he is imposing.



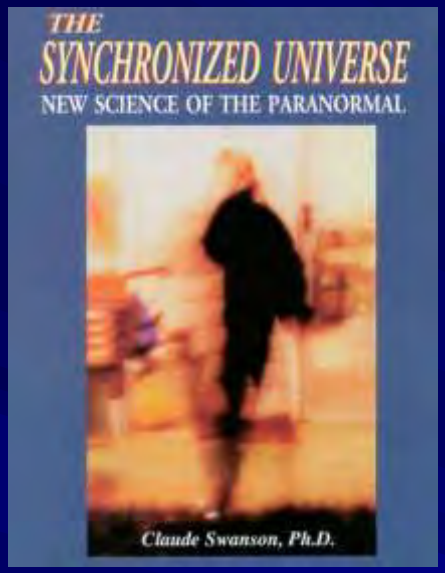
Dr. Michio Kaku is the co-creator of string field theory, a branch of string theory. He received a B.S. (summa cum laude) from Harvard University in 1968 where he came first in his physics class.

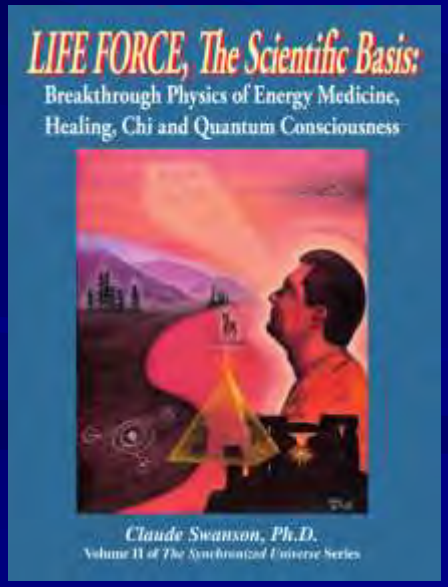
He went on to the Berkeley Radiation Laboratory at the University of California, Berkeley and received a Ph.D. in 1972. In 1973, he held a lectureship at Princeton University.

Michio continues Einstein's search for a "Theory of Everything," seeking to unify the four fundamental forces of the universe—the strong force, the weak force, gravity and electromagnetism.

http://www.cosmosmagazine.com/issues/2005/2/ http://www.cosmosmagazine.com/node/99

The Synchronized Universe - A new scientific revolution!





Physicist Dr. Claude Swanson, educated at MIT and Princeton University, describes the latest discoveries in Energy Medicine.

"We are learning the 'Secret of Life', how the body's trillons of cells grow, repair and heal… Electromagnetism and Earth energies hold part of the answer… we are witnessing the integration of CONSCIOUSNESS with physics"

It is called CHI, PRANA, MANA, ORENDO, WAKEN, BARAKA, and LIFE FORCE.

It is the energy which enables adepts, Yogis and Shamen to achieve the miraculous feats they do. It enables QiGong masters from China to project their energy over thousands of miles to heal injured cells and to cure cancer in laboratory experiments.

Today we have documented proof of how this energy changes the laws of physics, bringing together the Theory of Relativity and Quantum Mechanics, and is the explanation for many strange phenomena which we in the West call "paranormal."

http://synchronizeduniverse.com/

The Synchronized Universe Model (S.U.M.)

Assumes that all the particles in the universe interact with one another.

Local electrons are tied to distant matter via photons. The "virtual photons" in space are assumed to be created by the motions of other electrons. Most of them are created by the "distant matter" which contains almost all the matter of the universe.

The seemingly random "zig zag" dance they do is not random – it is really the communication between it and the distant matter – a purposeful, intimate and conscious dance with one another.

SO ALL THE EXISTING ELECTRONS AND PROTONS AND OTHER PARTICLES ARE ACTUALLY CONNECTED TO ONE ANOTHER!

Momentum and energy that is created here (locally) is absorbed there (universally) and vice versa, virtually instantaneously, able to travel backward in time as well as forward.

Photons which travel backwards in time are called "advanced waves", and are a perfectly valid solution of Maxwell's Equations which govern electromagnetism.

(from pgs 241 – 242 of The Synchronized Universe – Claude Swanson, PhD)

Conscious Creation

The law of gravity + the law of energy + The law of observation

The Law of Attraction is one of the most powerful laws governing the energy of the universe. Whether or not we understand it, like gravity, it affects our lives without fail and without discrimination.

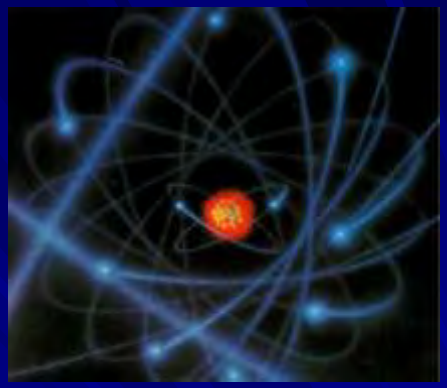
The law of attraction operates upon the vibration of our thoughts, with "like attracting like". Wherever we place our attention, energy and focus, with the corresponding emotional state or "feelings" about it… those frequencies will vibrationally attract the same of its kind.

(positivity = high vibration = health) (negativity = low vibration = disease)

Applying the Law deliberately to attract what we want in our lives is a practice of Conscious Creation through our thought process. It teaches the use of 'attention' and 'intention' to deliberately attract higher vibrations to enhance the quality of our lives…

Everything in the universe is made up of energy (atoms containing electrons, protons, neutrons, and quarks), and the law of observation states that **ENERGY FOLLOWS THOUGHT.**

Cellular communication – electrons and photons as messengers



Researchers have found that cells are in communication all the time. The DNA molecule, for example, radiates *and* absorbs in the millimeter wave band.

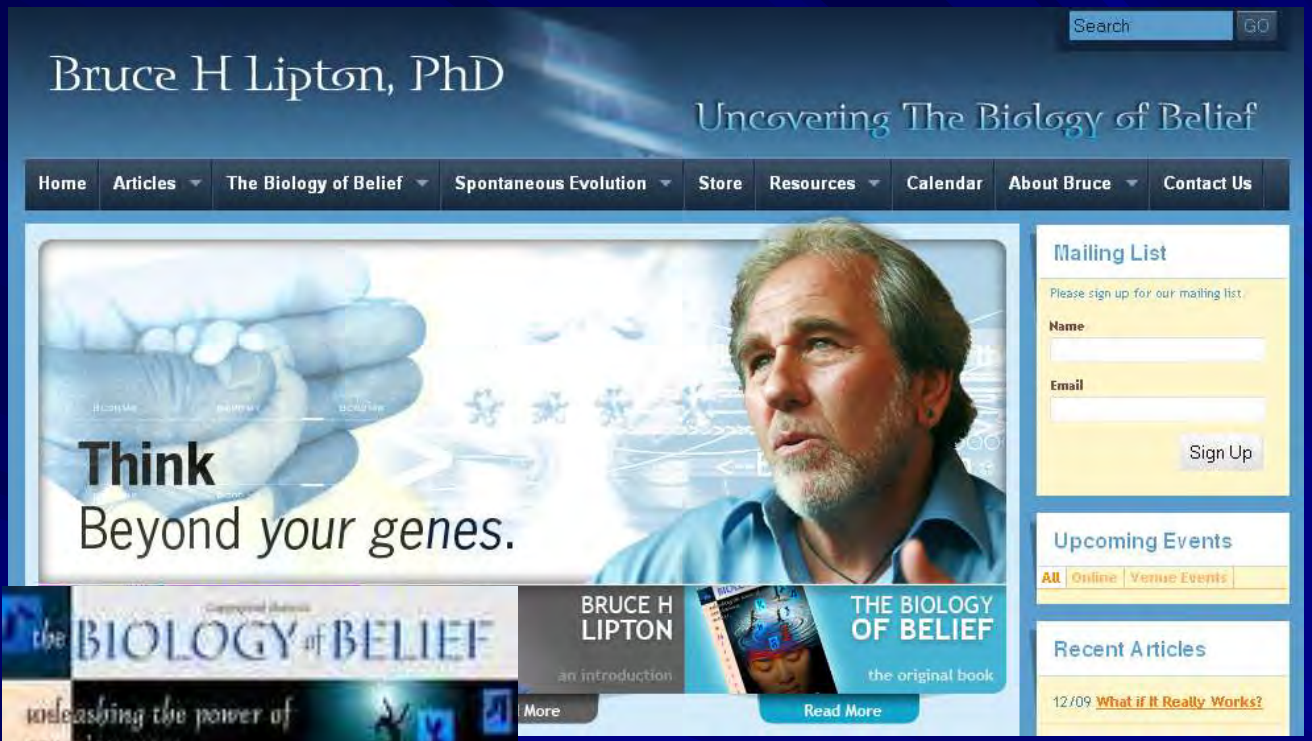
Can this be the source of the "Backster Effect", of cell-to-cellcommunication?

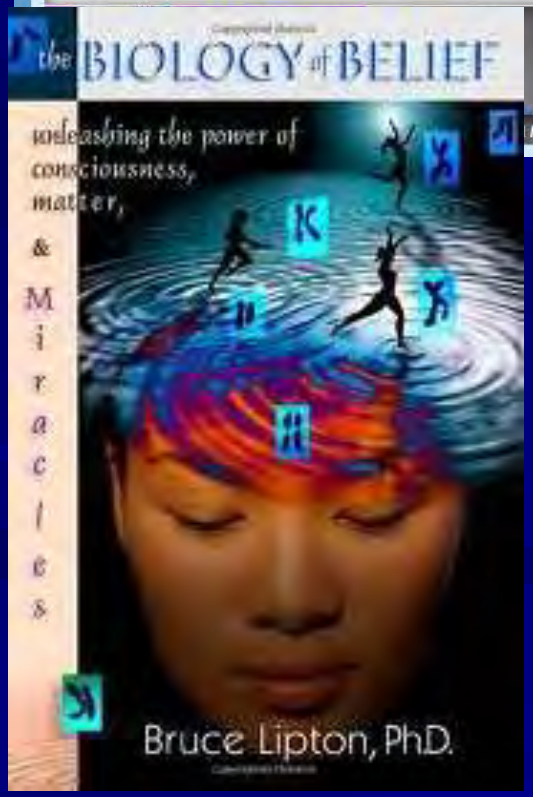
Backster Effect *– experiment postulating that plants can communicate with other lifeforms. By measuring the rate at which water rises from a philodendron's root into its leaves, using a polygraph to record altered electrical resistance signals from the plant taking up the water – surprisingly the graph tracing began to show a pattern typical of the response you get when you subject a human to emotional stimulation of short duration".*

Now It has been proven that a "sick" cell radiates *something*, and when a healthy cell receives this radiation, it too becomes sick *(Kaznachayev, 1967, 1981, 1982).* The opposite also occurs, sick cells can be brought back to health with radiation from healthy cells.

Can this explain "energy healing"? Source, strength and intention of the energy being radiated?

(from p. 234 of The Synchronized Universe – Claude Swanson, PhD)





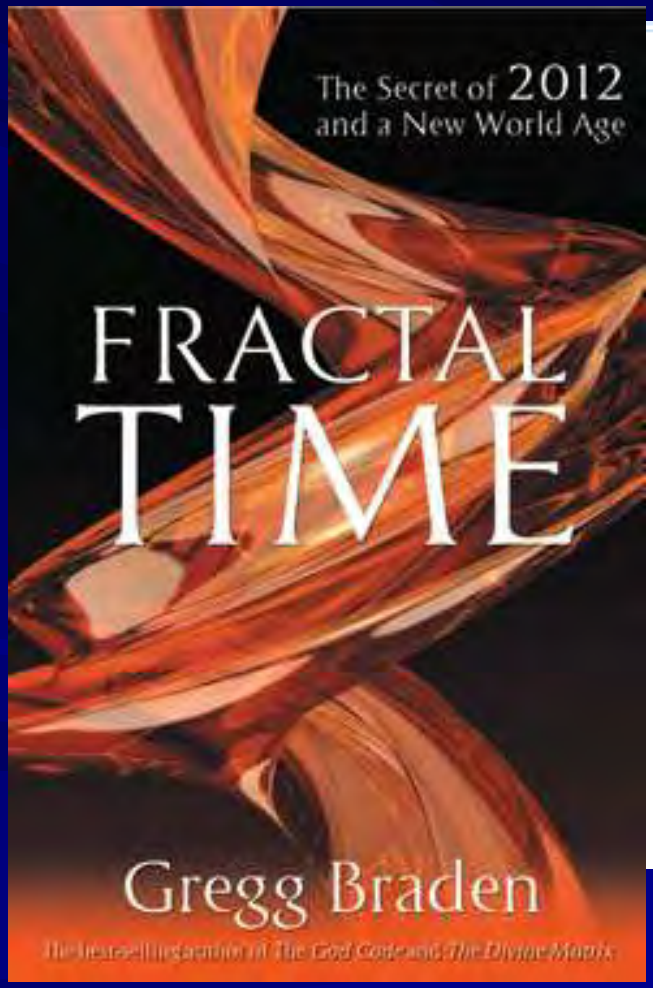
Dr. Bruce Lipton is an internationally recognized leader in bridging science and spirit.

The new sciences quantum physics and epigenetics are revolutionizing our understanding of the link between mind and matter.

By retraining our minds to create healthy beliefs, we can change the physiology of our trillion-celled bodies.

http://www.brucelipton.com/

We're living the end of time. Not the end of the world, but the end of a *world age* – a 5,125 year cycle of time – and the way we've known the world through out that time. The present world began in 3,113 B.C. and will end in A.D. 2012. Because the end of anything also marks the beginning of what comes next, we're also living the start of what follows the end of time: the next world age, which ancient traditions called the *great cycle.*



For at least four such cycles (or five, according to the Mesoamerican traditions of the Aztec and the Maya peoples), our ancestors endured the changes in global magnetic fields and climate, diminishing resources, and rising sea levels that come with the end of time. They did so without satellites and the Internet or computer models to help them prepare for such a radical shift.

The fact that they lived to tell the story stands as a powerful testament to an undeniable truth: it tells us beyond any reasonable doubt that the inhabitants of our planet have survived the end of world ages in the past. Beyond simply surviving, our ancestors learned from the difficulties that can accompany the change. In the words of their day, they did their best to tell us what it means to live such a rare moment in history. It's a good thing they did, because such events are few and far between. Only five generations in the last 26,000 years have experienced the shift of world ages. We will be the sixth.

http://www.greggbraden.com/home/fractal-time-calculator/

What Can We Expect?

2012 Reference Dates and Their Conditions

Present Time	Magnetic Strength	Solar Output	Climate Status	Civilization Status
Early 2008				
End of Cycle	~7.5 Units	Sharp Increase	*Warming +.6/-.2C *Polar-Ice Collapse *Sea-Level Rise	*Multiple Wars *Collapsing Economy *Overextended Military

Previous Cycle	Magnetic Strength	Solar Output	Climate Status	Civilization Reference Date
5,125-Year				
Reference Date				
1155 B.C.	~10.5 Units	Sharp Increase	*Warming +1C *Polar-Ice Collapse *Sea-Level Rise	*Collapse of Egypt's 20th Dynasty *Multiple Wars *Overextended Economy

Previous Cycle	Magnetic Strength	Solar Output	Climate Status	Civilization Reference Date
26,000-Year				
Reference Date				
13,824 B.C.	~5.25–7.25 Units	Sharp Increase	*Warming +2C	*No Civilization as We Now Know It

Figure 15. This summary shows the key conditions for the 2012 reference dates indicated by the Time Code Calculator for both the 5,125-year world age and the 26,000-year precessional cycle. The similarities in the conditions between these two vastly different times in our past are striking. If the cycles of nature follow the patterns of the past, these indicators give us a concrete idea of what we can expect in the 2012 transition between world ages.

Solar Storms – increasing activity and intensity thru 2012

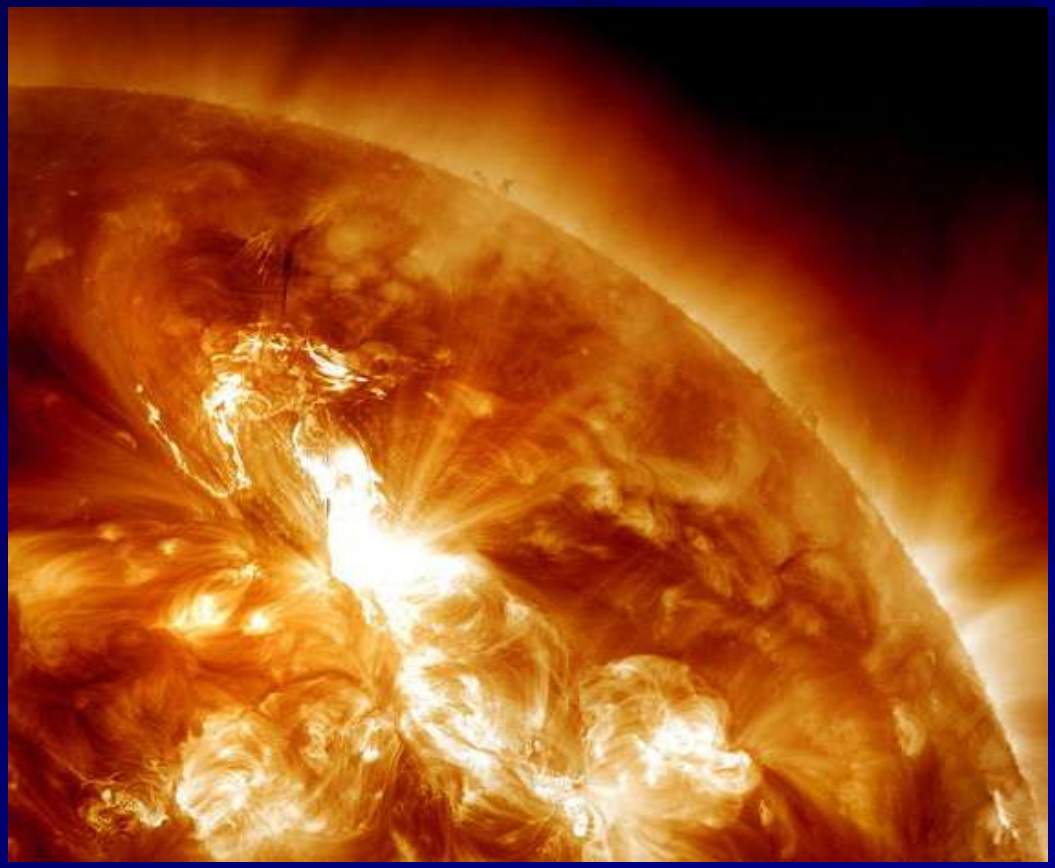


Image provided by NASA, taken Sunday night, Jan. 22, 2012, shows a solar flare erupting on the Sun's northeastern hemisphere. Space weather officials say the strongest solar storm in more than six years is already bombarding Earth with radiation with more to come.

An aurora appears when a magnetic solar wind slams into the Earth's magnetic field, exciting electrons of oxygen and nitrogen.

According to the National Oceanic and Atmospheric Administration, problems can include current surges in power lines, and interference in the broadcast of radio, TV and telephone signals.

Scientists have been expecting solar eruptions to become more intense as the sun enters a more active phase of its 11-year cycle, with an expected peak in 2013.

The Earth's Magnetic Field is Weakening

Over the last 165 years, scientists have measured the Earth's magnetic field and have recorded a decline of its' strength.
Today the magnetic field of the Earth is measured at 0.5 gauss. It is estimated that the field of the Earth 4,000 years ago was 5.0 gauss.

That is a decrease of 90%!

In addition, the Earth's natural magnetic signal is often distorted by our modern way of living. The power grid, electrical appliances, mobile phone's, mobile phone towers, Satellite signals, TV broadcast stations, tall buildings, asphalt, draining pipes and more are responsible for us not getting the signals we have evolved to. The immune system suffers because of this.

Depression and Earth's weakening Magnetic Field

Earth's declining magnetic field may be one of the factors leading to the alarming rise in cases of clinical depression and suicide.

In 2008, Russian scientists found a correlation between Earth's declining magnetic field and suicide. Oleg Shumilov of the Institute of North Industrial Ecology Problems in Russia, told the New Scientist the Earth's magnetic field peaked in three cycles during the year; March to May, another in July with the last in October. Shumilov argues that many animals can sense the magnetic field, so why should this not be the case with humans?

Michael Rycroft, formerly head of the European Geosciences Society, quoted by the New Scientist, claims that around 10 to 15% of the population are affected by geomagnetic health problems.

Dementia, depression and mental disorders are on the rise worldwide. If it turns out Earth is entering a new phase of accelerated field declination, which I believe it is, and artificially induced electro-magnetic field disturbances continue on Earth; depression and rates of suicide on the planet could start spiking.

http://www.prometeus.nsc.ru/science/scidig/08/apr2.ssi

Electromagn Biol Med. 2010 Aug;29(3):105-12.

A role for the geomagnetic field in cell regulation.

Liboff AR.
Center for Molecular Biology and Biotechnology, Florida Atlantic University

Abstract

We advance the hypothesis that biological systems utilize the geomagnetic field (GMF) for functional purposes by means of ion cyclotron resonance-like (ICR) mechanisms.

Numerous ICR-designed experiments have demonstrated that living things are sensitive, in varying degrees, to magnetic fields that are equivalent to both changes in the general magnetostatic intensity of the GMF, as well as its temporal perturbations. We propose the existence of ICR-like cell regulation processes, homologous to the way that biochemical messengers alter the net biological state through competing processes of enhancement and inhibition. In like manner, combinations of different resonance frequencies all coupled to the same local magnetic field provide a unique means for cell regulation.

PMID:20707644 [PubMed - indexed for MEDLINE]

Bioelectromagnetics. 2009 Jan;30(1):21-8.

Prolonged weakening of the geomagnetic field (GMF) affects the immune system of rats.

Roman A, Tombarkiewicz B.
Department of Brain Biochemistry, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland. roman@if-pan.krakow.pl

PubMed.gov
U.S. National Library of Medicine
National Institutes of Health

We found that the long-term shielding of the GMF could influence the functioning of the immune system in a sex-dependent manner.

The deprivation of the GMF delayed physiological thymus involution, that effect being more strongly expressed in females. The weakening of the GMF resulted in an increased number of peritoneal macrophages, especially in males.

The shielding of the GMF diminished the ability of macrophages to release NO and to synthesize O2(-), those effects being more powerfully expressed in males and females, respectively.

It is proposed that the observed changes in the immune system occur as a consequence of the protective effect of GMF shielding on the circadian rhythm-dependent level of melatonin.

PEMF – The Fifth Element

Most people know we need food (earth), water (water) and oxygen (air) to survive.

And many people also know they need full spectrum sunlight (fire) or you get what is referred to as SAD (seasonal affective disorder).

That makes FOUR critical elements:

EARTH/FOOD

WATER

FIRE/SUNLIGHT

AIR/OXYGEN

However, every organism on earth (that includes people) has evolved to the natural magnetic signals of the earth and that part of the solar radiation that is able to penetrate our atmosphere.

We have learned that these PEMF signals are of great importance to internal regulation of every organism.

http://www.pemft.net/the-5th-element.html

PEMF's are like a spark plug or catalyst for energy production in the cell.

Just like a car needs oxygen, fuel and an ignition or spark plug, so does the human cell need fuel (glucose), oxygen and a "spark plug" or ignition. This ignition is PEMF or pulsed magnetic energy from both the earth and movement/exercise on the earth.

We can also think of PEMF as a battery recharger for the human cell. We now know that the voltage of a healthy cell is about 70-110 millivolts and when we get sick that voltage drops below 50 millivolts or less and cancer cells are 30 millivolts or less. Pulsed electromagnetic fields (PEMF) act like a catalyst and battery recharger for the human cells and these PEMF's are critical for human metabolism.

PEMF's also improve microcirculation, oxygenation (up to a 200% increase), help in nerve regeneration, pain management and many other health promoting benefits. There are over 1000 clinical studies and over 7000 research papers validating the therapeutic benefits of PEMFs.

http://www.pemft.net/the-5th-element.html

Dr. Oz Recommends PEMF

Pulsating Electromagnetic Therapy is shifting the paradigm of pain management

Pulsed electromagnetic field (PEMF) therapy is FDA-approved to fuse bones and has been cleared in certain devices to reduce swelling and joint pain.

Transcranial Magnetic Stimulation (TMS) and Magnetic Resonance Imaging (MRI) work on the same physics.

All energy is electromagnetic in nature. All atoms, chemicals and cells produce electromagnetic fields (EMFs).

Every organ in the body produces it own signature bioelectromagnetic field.

Science has proven that our bodies actually project their own magnetic fields and that all 70 trillion cells in the body communicate via electromagnetic frequencies.

Nothing happens in the body without an electromagnetic exchange. When the electromagnetic activity of the body ceases, life ceases.

Watch this amazing 10 minute video to learn more…
http://www.youtube.com/watch?v=cZSOKT-IdFE

Dr. William Pawluk, MD, MSc, appeared as PEMF Specialist on the Doctor Oz TV Show in November 2011, where they discussed the most effective types of pulsed electromagnetic field therapy.

http://www.drpawluk.com/doctor-oz-article-on-pemfs/

http://www.doctoroz.com/videos/ask-your-doctor-about-pulsed-electromagnetic-field-therapy

Dr. Pawluk

"YOUR MEDICALLY-BASED SOURCE ON MAGNETIC FIELD THERAPY"

Dr. Pawluk's Blog: Practical applications of PEMF therapies

The PEMF-100 device is an innovative, high intensity, very low frequency pulsed electromagnetic field generator. It is one of the most intense clinically useful electromagnetic devices available. The maximum field intensity is around 1920 Gauss (192 mT). The lowest field intensity is still likely close to 1000 Gauss.

Why are magnetic fields important to your health?

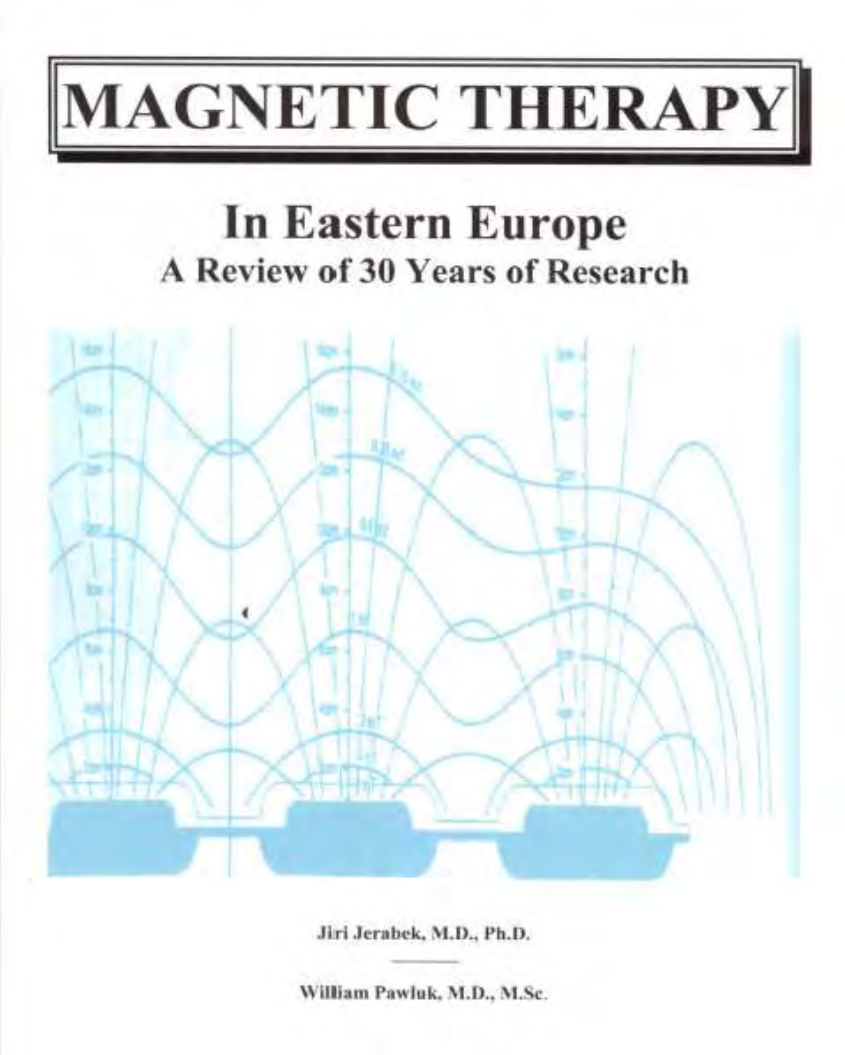
What should you know about pulsed electomagnetic field treatment?

http://www.drpawluk.com/

Magnetic Therapy in Eastern Europe: A Review of 30 Years of Research

By Jiri Jerabek, MD, PhD and William Pawluk, MD, MSc

The book presents information summarizing conditions studied, magnetic field strength and type of field used, frequency and duration of application and summary of actual results. There are detailed descriptions of many studies on both static (permanent) and frequency (pulsed) fields.



Controlled human studies described include:

- **Atherosclerosis**
- **Brain neurosecretion**
- **Breast fissures**
- **Burns**
- **Carpal tunnel syndrome**
- **Cervicitis**
- **Chronic bronchitis**
- **Controlled Studies Animals**
- **Corneal trauma**
- **Edema**
- **Endometriosis**
- **Femoral artery surgery**
- **Fractures**
- **Increased circulation**
- **Infected skin wounds**
- **Ischemic heart disease**
- **Limb grafts**
- **Liver function**

And more…

We are only as healthy as our cells.

"By regenerating the cells in our bodies we can help our cells become and stay healthy with pulsed electromagnetic fields.

The earth creates magnetic fields, without which life would not be possible. Science teaches that everything is energy. All energy is electromagnetic in nature. All atoms, chemicals, and cells produce electromagnetic fields. Science has proven that our bodies actually project their own magnetic fields and our seventy trillion cells in the body communicate via electromagnetic frequencies.

Disruption of electromagnetic energy in cells causes impaired cell metabolism. This is the final common pathway of disease. If cells are not healthy, the body is not healthy."

William Pawluk, MD, MSc, and Donna Ganza, ND
Excerpt from 101 Great Ways to Improve Health

Volume 25 | Issue 5 | Page 30
Date: 2011-05-01

Power Failure

Does mitochondrial dysfunction lie at the heart of common, complex diseases like cancer and autism?

By Megan Scudellari

Over the last five years, a growing number of papers by researchers around the world have implicated dysfunctional mitochondria in many elusive diseases, including Parkinson's, autism, and aging.

Leading the charge is a respected and renowned member of the National Academy of Sciences, Dr. Douglas Wallace, founder of the field of human mitochondrial genetics.

> ***"Every one of the diseases we can't solve is absolutely logical if we put energy at the center,"*** Dr. Wallace says.

Medicine fails to solve many of today's common, complex diseases, Wallace asserts, because the fundamental paradigm is wrong: the medical establishment has spent far too long focusing on anatomy and ignoring energy—specifically, mitochondria.

The cells of living tissue are electrical direct current (DC) systems

All life generates an electrical DC charge

This natural DC charge is created by the movement of ions in and out of cell membranes which are responsible for a healthy cell membrane's electrical charge of approximately – 70 mV.

***Any challenge to the cell*, such as oxygen/nutrient deficiency, toxicity, tissue changes or inflammation, alters ion movement and the charge on the cell membrane changes.**

This altered charge profoundly affects the homeostasis of the cell and normal metabolic processes, including the movement of nutrients into, and waste products of metabolism out of the cell.
~ Martin Milner, ND

Damaged cells are energy deficient…

They have low oxygen levels, are high in sodium levels, and have a faltered electrochemical gradient. By inducing a mild electrical current into damaged cells, PEMF therapy slows or stops the release of pain and inflammatory mediators, increases blood flow, and re-establishes normal cell interaction.

PEMF stimulates and restores the electrochemical gradient, the cell starts pumping sodium out, potassium enters the cell, the swelling resolves, oxygen starts flowing back in, and pain improves. Due to the density of the cell tissue, change requires stronger pulsed magnetic fields to be able to restore the healthy TMP to its optimal -70 mV.

Several factors influence tissue inflammation and the processes by which PEMF therapy operates to reduce inflammation include complex mechanical, chemical, electrical and magnetic processes along with increased circulation, oxygenation and cellular activity.

With reduced inflammation, pain decreases and faster tissue healing occurs.

PEMF.US

Pulsed Electro-Magnetic Field

PMT-100

The Solution

With more than 40 years of clinical studies, researchers believe that the pulsed signal nudges the body's chemistry so the healing process may proceed more rapidly.

http://www.pemf.us

Reported PEMF Benefits:

- Reduced pain
- Reduced inflammation
- Increased range of motion
- Faster functional recovery
- Reduced muscle loss after surgery
- Increased tensile strength in ligaments
- Faster healing of skin wounds
- Enhanced capillary formation
- Accelerated nerve regeneration
- Reduced tissue necrosis

In the "Beneficial effects of electromagnetic fields", Bassett C. (*Bioelectric Research Center, Columbia University, NY, 1993*)

Study applied time-varying pulsed magnetic fields designed to induce voltages similar to those produced normally during the dynamic mechanical deformation of connective tissues in an effort to control cellular function and understand the mechanisms by which PEMF treatment operates and concluded:

"As a result, a wide variety of challenging musculoskeletal disorders has been treated successfully over the past two decades... Many of the athermal bioresponses, at the cellular and subcellular levels, have been identified and found appropriate to correct or modify the pathologic processes for which PEMFs have been used… As understanding of mechanisms expands, specific requirements for field energetics are being defined and the range of treatable ills broadened. These include nerve regeneration, wound healing, graft behavior, diabetes, and myocardial and cerebral ischemia (heart attack and stroke), among other conditions. Preliminary data even suggest possible benefits in controlling malignancy".

Attributes of PEMF
How Does PEMF Work?

1. Atomic excitement/electron spin to increase and store energy.

2. Molecules tend to align slightly with each magnetic pulse, making them easier to combine, especially when excited.

3. The pH goes a hundred times more alkaline, which allows better oxygen uptake, and suppresses some harmful entities.

4. The viscosity shifts on the order of 16 fold, allowing liquids to flow into cell gates, or lymph to thin and flow.

5. Red blood cells separate (probably all take a positive charge and repel each other) in minutes, allowing more surface area to transport oxygen.

6. Relaxing of the vascular system within minutes of completing a session, which drops blood pressure by up to twenty percent 30 minutes after.

7. Wound healing increases by 30%. There is systemic response to the sessions as though the body's functions have been fine tuned, or turbo charged. Many different problems get better, often not the targeted problems only, but things not expected to get better.

8. Bone mending, the quality of calcium, is one-third normal time, and the skin of the bone seems to develop cells more like the DNA dictates.

9. Electroporation is the phenomena wherein the cells gates open to allow more passage of solvent (H20) to dissolve toxins, or allow better delivery of a medicine or herbs.

10. Sodium potassium exchange, which is documented in a US Army study to reduce pain, often within minutes of treatment.

The Electrical Properties of Cancer Cells

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

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. (Pg 3)

PEMF Therapy Stimulates Cellular Communication and Replication

DNA synthesis is linked to pulsed, low intensity magnetic fields (*Liboff et al., 1984; Rosch et al., 2004*). Proteins are conductors of electricity. When exposed to strong fields, proteins are subject to electrophoresis.

The Ribonucleic Acid ("RNA") messengers that are synthesized from a Deoxyribonucleic Acid ("DNA") template during transcription mediate the transfer of genetic information from the cell nucleus to ribosomes in the cytoplasm and serve as a template for protein synthesis.

Since RNA mechanically influences the DNA and encoded proteins influence RNA, the flow of information to and from genes may be linked to changing magnetic fields (*Einstein, 1977; Goodman et al., 1983*).

Since magnetic fields interact with changing electrical charges and recent studies (*Dandliker et al., 1997*) show that DNA conducts electrons along the stacked bases within the DNA double helix, electro-magnetic fields may initiate transcription of the precursor mRNA by accelerating electrons moving within the DNA helix (*McLean et al., 2003*).

British Journal of Cancer - 17 January 2012

Treating cancer with amplitude-modulated electromagnetic fields: a potential paradigm shift, again?

C F Blackman - Integrated Systems Toxicology Division (B-105-03), US Environmental Protection Agency, Research Triangle Park, NC 27711, USA

The Zimmerman *et al* (2012) study published here, coupled with the group's two preceding papers (Barbault *et al*, 2009; Costa *et al*, 2011), identify a potential modality for treating tumours at a dramatic reduction in trauma and cost. This set of clinical and explanatory laboratory results should be understood in the context of the history of research into the biological effects of electromagnetic fields (EMFs).

Costa *et al* (2011) reported surprising clinical benefits from using the specific AM-EMF signals to treat advanced hepatocellular carcinoma, stabilising the disease and even producing partial responses up to 58 months in a subset of the patients.

Now Zimmerman *et al* have examined the growth rate of human tumour cell lines from liver and breast cancers along with normal cells from those tissues exposed to AM-EMF.

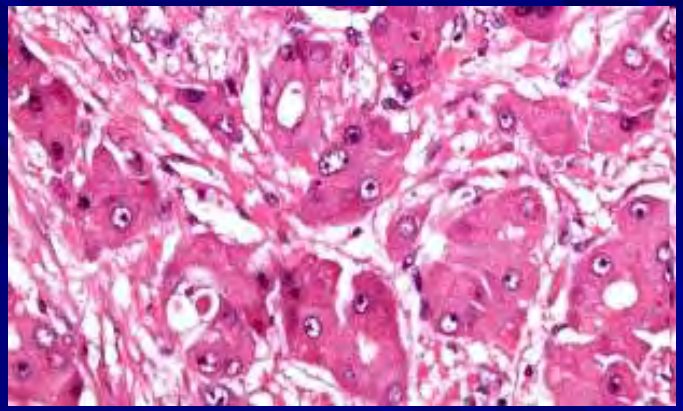
Reduced growth rate was observed for tumour cells exposed to tissue-specific AM-EMF, but no change in growth rate in normal cells derived from the same tissue type, or in tumour or normal cells from the other tissue type.

(2012) 106, 241–242. doi:10.1038/bjc.2011.576 www.bjcancer.com

Electromagnetic Fields Shrink Tumors

New research shows that low-intensity fields can inhibit cancer cell proliferation.

By Bob Grant | The Scientist | January 11, 2012



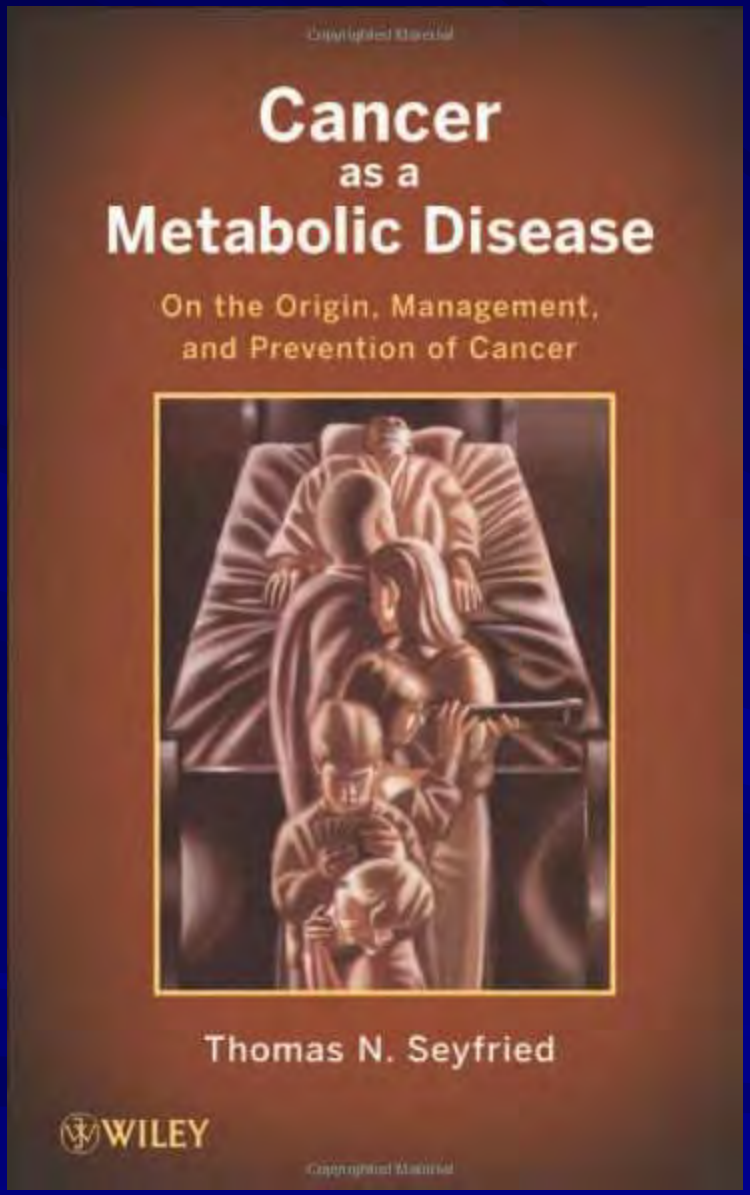
Very high magnification micrograph of fibrolamellar hepatocellular carcinoma
Wikimedia Commons, Nephron

Researchers have demonstrated that small doses of **electromagnetism can shrink liver and breast cancer cells without harming surrounding tissues**, according to a report published recently in the *British Journal of Cancer*.

An international team, led by University of Alabama at Birmingham oncologist Boris Pasche, has shown that low-intensity electromagnetic fields can slow the proliferation of and hepatocellular carcinoma (HCC) cells, which are involved with a deadly form of liver cancer, and breast cancer cells. *"This is a truly novel technique,"* Pasche told *The Guardian*. *"It is innocuous, can be tolerated for long periods of time, and could be used in combination with other therapies."*

In August, Pasche and his colleagues published a *British Journal of Cancer* paper showing that they could slow tumor growth in some HCC patients by treating them with low-level electromagnetic fields on a regular basis. In total, 41 patients received the treatments… after 6 months of treatment, tumor growth in 14 of those patients had stabilized, and **none experienced negative side effects.**

http://the-scientist.com/2012/01/11/electromagnetic-fields-shrink-tumors/



Cancer as a Metabolic Disease

[excerpts from pg(s) 5-6 and 17]

Radiation therapy is given to many cancer patients. Radiation will kill both cancer cells and normal cells.

Some normal cells that are not killed outright can be metabolically transformed into tumor cells.

Moreover, those tumor cells that survive the radiation treatment will sometimes grow back as more aggressive and less manageable cancers in the future.

Emerging evidence suggests that cancer is a metabolic rather than genetic disease.

Cancer is a disease of defective cellular energy metabolism, and most of the genomic defects found in cancer arise as secondary downstream effects of defective energy metabolism.

Advanced cancer patients overoptimistic about chemotherapy's ability to cure, study finds…

October 24, 2012

BOSTON—Findings from a nationwide study led by researchers at Dana-Farber Cancer Institute suggest that patients with advanced lung or colorectal cancer are frequently mistaken in their beliefs that chemotherapy can cure their disease.

The study, published in the Oct. 25 issue of the *New England Journal of Medicine*, found that 69 percent of patients with advanced lung cancer and 81 percent of patients with advanced colorectal cancer did not understand that the chemotherapy they were receiving was not at all likely to cure their disease.

Their expectations run counter to the fact that although chemotherapy can alleviate pain and extend life in such patients by weeks or months, it is not a cure for these types of advanced cancer except in the rarest of circumstances.

***"There is a lot of harm in not having patients understand the finality of the disease,"* said Borghaei. Chemo drugs *"are very powerful, they have a lot of side effects, the chemotherapy is going to harm you more than it helps you, and it can actually shorten your life.* All of this should be taken into account."**

http://mobile.reuters.com/article/idUSBRE89N1M220121024?irpc=932

Harvard Health Publications
HARVARD MEDICAL SCHOOL
Trusted advice for a healthier life

Global cancer research database reveals what you can do to lower your risk

POSTED AUGUST 30, 2012, 11:00 AM
Daniel Pendick, Executive Editor, *Harvard Men's Health Watch*

By the year 2030, the number of people diagnosed annually with cancer worldwide could reach 21 million. This week, the Union for International Cancer Control (UICC) is meeting in Montreal to discuss how to diminish the rising tide of cancer.

The long-term solution, experts think, lies in another startling statistic: that 40% of cancers stem from factors that we can control.

At the meeting, the American Institute for Cancer Research and the World Cancer Research Fund International (AICR/WCRF) rolled out the **latest update** to the world's largest central database of research on how lifestyle choices influence the risk of cancer. Key causes of "preventable" cancer include unhealthy diets, lack of exercise, being overweight, alcohol and tobacco, and not taking full advantage of preventive vaccinations and screenings.

"The fact is that changes in our lifestyle can powerfully protect us against cancer," says Dr. Anthony Komaroff, editor in chief of the *Harvard Health Letter* and a professor of medicine at Harvard Medical School. "In fact, we can do more to protect ourselves against cancer than our doctors can do for us."

40% of cancers stem from factors that we CAN control

Key causes of "preventable" cancer include unhealthy diets, lack of exercise, being overweight, alcohol and tobacco…

"we can do more to protect ourselves against cancer than our doctors can do for us" ~ Dr. Anthony Komaroff editor-in-chief, Harvard Health Letter

http://www.health.harvard.edu/blog/data-show-that-a-healthy-lifestyle-can-lower-cancer-risk-201208305223

The Prime Cause and Prevention of Cancer

Dr.Otto Warburg – 1931 Nobel Laureate

Dr. Warburg stated "Cancerous tissues are acidic, whereas healthy tissues are alkaline. Water splits into H+ and OH- ions, if there is an access of H+, it is acidic; if there is an excess of OH- ions, then it is alkaline."

…tumors live in the body anaerobically.

…cell respiration is impaired if the active groups of the respiratory enzymes are removed from the food; and that cell respiration is repaired at once, if these groups are added again to the food. No way can be imagined that is scientifically better founded to prevent and cure a disease, the prime cause of which is an impaired respiration.

…the prevention of cancer requires no government help, and no extra money.

Healthy tissues are alkaline whereas cancerous tissues are acidic. Cancer does not survive in an alkaline state.

Mol Aspects Med. 2010 Feb;31(1):60-74. Epub 2009 Dec 6.

The Warburg effect and mitochondrial stability in cancer cells.

Gogvadze V, Zhivotovsky B, Orrenius S.
Institute of Environmental Medicine, Division of Toxicology, Karolinska Institutet, Box 210, Stockholm SE-17177, Sweden.

Abstract

The last decade has witnessed a renaissance of Otto Warburg's fundamental hypothesis, which he put forward more than 80 years ago, that mitochondrial malfunction and subsequent stimulation of cellular glucose utilization lead to the development of cancer.

Since most tumor cells demonstrate a remarkable resistance to drugs that kill non-malignant cells, the question has arisen whether such resistance might be a consequence of the abnormalities in tumor mitochondria predicted by Warburg.

The present review discusses potential mechanisms underlying the upregulation of glycolysis and silencing of mitochondrial activity in cancer cells, and how pharmaceutical intervention in cellular energy metabolism might make tumor cells more susceptible to anti-cancer treatment.

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CAUSE OF CANCER & pH

by Herman Aihara, author of "Acid & Alkaline"

If the condition of our extra cellular fluids, especially the blood, becomes acidic, our physical condition will first manifest tiredness, proneness to catching colds, etc. When these fluids become more acidic, our condition then manifests pains and suffering such as headaches, chest pains, stomach aches, etc.

According to Keiichi Morishita in his Hidden Truth of Cancer, If the Blood develops a more acidic condition, then our body inevitably deposits these excess acidic substances in some area of the body such so that the blood will not be able to maintain an alkaline condition which causes these areas such as the cells to become acidic and lowers in oxygen.

Some cells, instead of dying - as normal cells do in an acid environment - survive by becoming abnormal cells. Abnormal, or malignant cells THRIVE in an acidic and anaerobic (low oxygen) environment.

They do not correspond with brain function, nor with our own DNS memory code. This is cancer.

pH (Hydrogen potential) and Electrons
An Overlooked Key Nutrient

All physical things are comprised of atoms. An atom consists of a central nucleus which is positively charged, and electrons which are negatively charged in shells or orbits around that central nucleus.

Atoms combine with one another because of their desire to lose, gain, or share electrons.

The phenomenon of electrons from one atom being shared with another atom is essential for construction of the complex biochemical compounds, organelles, cells, tissues, and organs comprising life.

The release of energy as electrons move from one energy level to another is responsible for the energy required in all body processes.

Modern living has created an electron-deficient environment that is creating electron-deficient bodies. Electron Deficiency is another way of saying something is Acidic.

Electrons – An Overlooked Key Nutrient

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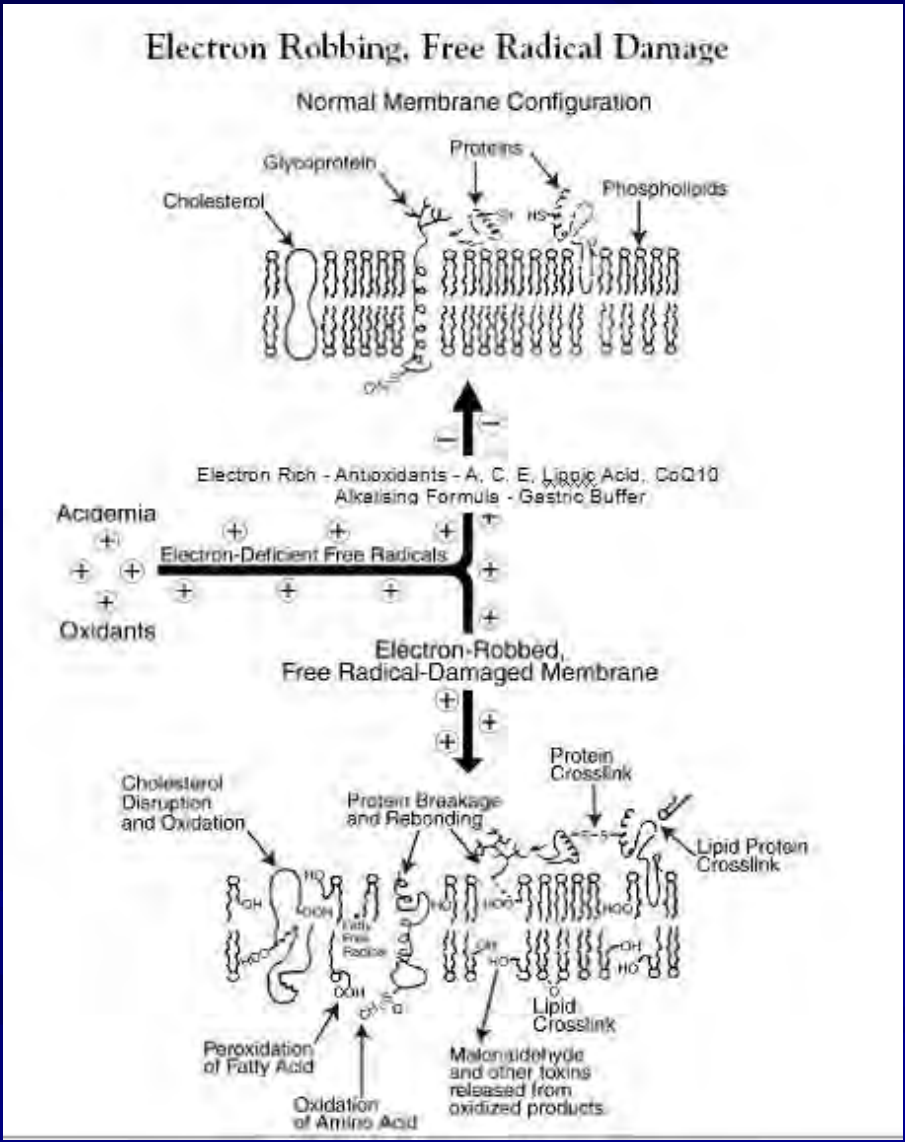
Signs and Symptoms of Electron Deficiency

- Periodontal disease
- Dental caries
- Bleeding gums
- Calculus (calcium scale) on teeth
- Halitosis, bad breath
- Osteoarthritis
- Pseudo-gout
- High blood pressure / hypertension
- Cancer
- Obesity
- Osteoporosis
- Urinary stones
- Premature aging
- Muscle atrophy
- Allergies
- Autoimmune diseases
- Repeated infection
- Digestive problems
- Chronic nasal sinus congestion
- Headaches
- Poor sleep patterns
- Erratic mood swings
- Loss of good vision and hearing
- Depression and psychological maladies
- Loss of mental acuity
- Low energy
- Loss of vitality

Clinical Markers of Electron Deficiency

1. Urine pH below 5.5 and Salivary pH below 6.0
2. White Blood Cells or Bacteria in urine
3. Positive Urine Nitrate
4. Free Calcium Risk Index above 0.8 *(calculated by multiplying phosphorus by 2.5 and subtracting that from measured calcium).*
5. LDH (Lactic Dehydrogenase) < 200 mg./dl.
6. Oxygen Saturation Low
7. Phosphorus level below 3.6 mg./dl
8. Albumin level below 4.0 mg./ dl
9. Calcium Oxalate crystals in the Urine
10. Elevated Monocyte count
11. Elevated Globulin
12. Albumin - Globulin ratio of 1.7 or less
13. Elevated Fibrinogen
14. T-cell activation
15. Alteration in the Porphyrin profile
16. Elevated malondialdehyde
17. Elevated total conjugated dienes
18. Elevated Pentane, Ethane or Hydrocarbon levels
19. Increased loss of integrity of red blood cells as indicated by a Low-Normal G-6 PD / High Normal Total Bilirubin (0.9-1.3).

Oxidation and Reduction



Electron excess and deficiency can also be understood in terms of oxidation and reduction.

An oxidant is a chemical that is deficient in electrons and tends to take them from others. If a compound has its electrons stolen by an oxidant, it is said to be oxidized.

A reducing agent is a chemical that donates electrons to another chemical. The chemical that receives the electrons is said to be reduced.

An oxidation-reduction chemical reaction is one in which some chemicals are receiving electrons and others are losing them.

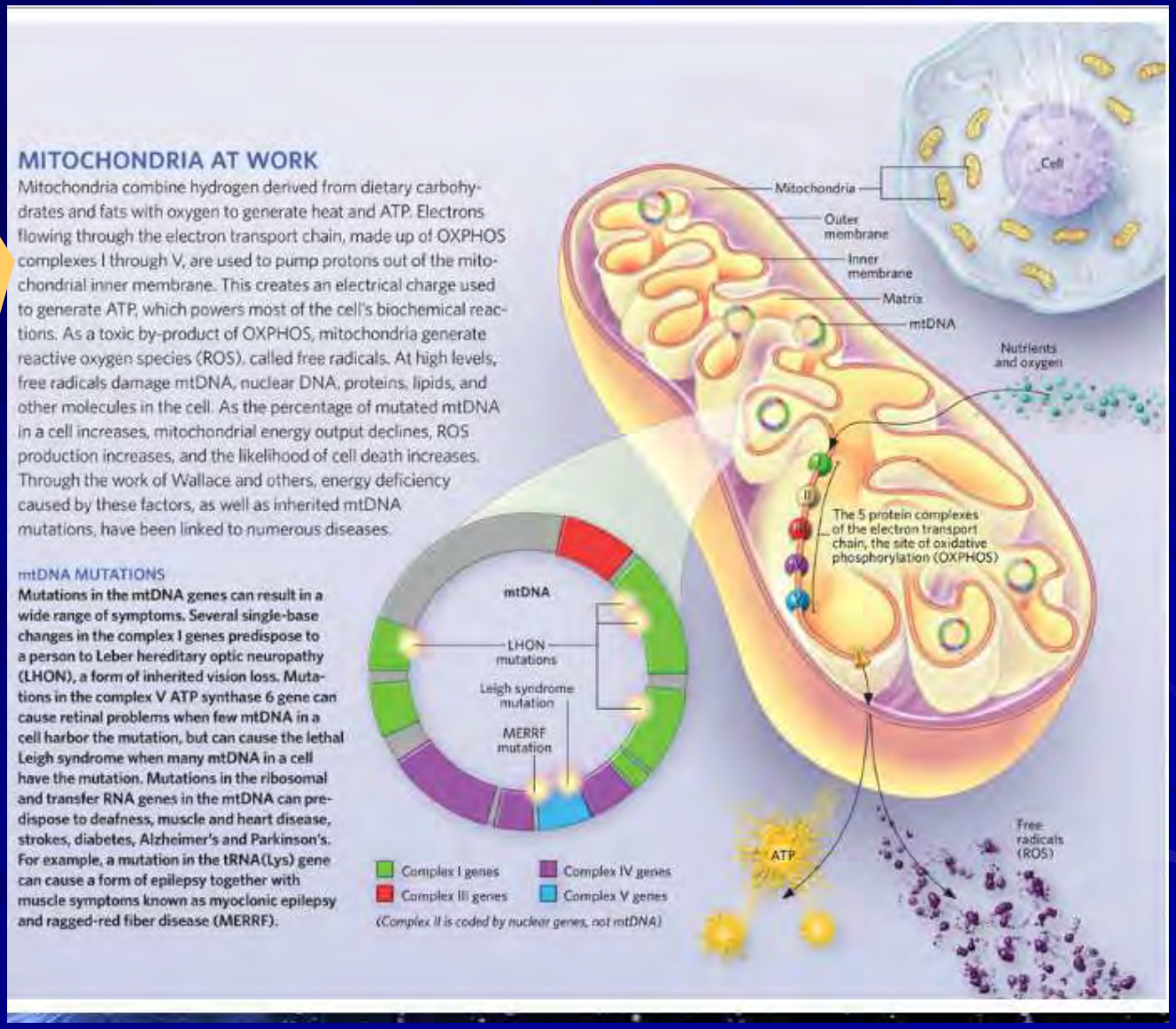
Oxidation-reduction reactions occur continuously in the body.

Mitochondria – The Body's Powerhouse

Mitochondria combine hydrogen derived from dietary carbs and fats with oxygen to generate heat and ATP.

Electrons flowing through the electron transport chain, made up of OXPHOS complexes I through V, are used to pump protons out of the mitochondrial membrane.

This creates an ELECTRICAL CHARGE used to generate ATP, which powers most of the cell's biochemical reactions.



http://images.the-scientist.com/content/images/articles/58132/mitochondria_at_work.jpg

Pappas' equation of nuclear fusion

on the level of the living cell, indicating its relation to the involved vital energies as an exothermic reaction:

$$_{11}Na^{23} + _{8}O^{16} + \text{Electrical Excitation} + \text{ATP Energy} = _{19}K^{39} + \text{Bio Energy}$$

The Sodium-Potassium pump is assumed a molecular exchange, but actually it is a nuclear process of fusion under electrical excitation of Na nucleus, firstly by the charged cell membrane, and secondly via an endothermic catalytic action of ATP.

The electrical excitation of the Na nucleus *may be assisted externally by appropriate strong electrical nanopulses.*

The nuclear fusion of Na to K by Oxygen seems to be the most important function of the cell and the key to its life and metabolism. A great number of other biological and medical functions and malfunctions are better understood by standard osmosis related mechanisms alone, and via the above nuclear fusion as well the equivalent to its reverse for example:

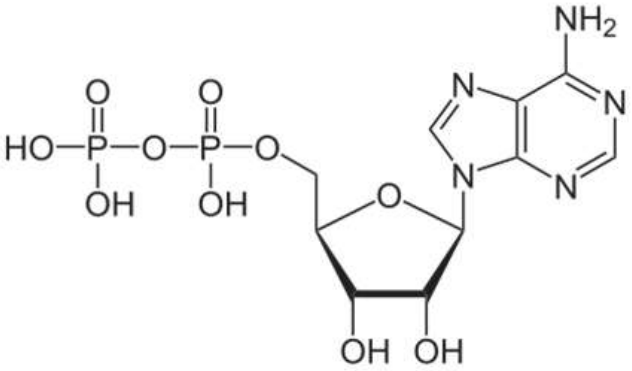
$$_{19}K^{39} = _{11}Na^{23} + _{8}O^{16} - \text{Electrical Current Energy}$$

PEMF Therapy Increases Energy Storage and Cellular Activity

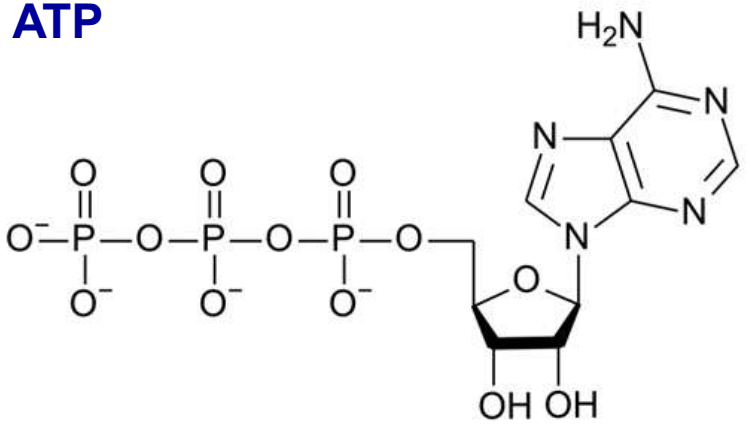
At the sub-atomic level, as the pulsed fields expand and collapse through a tissue, the protein molecules, such as the cytochromes in the cells' mitochondria, gain electrons and, in doing so, store energy.

The average total energy transmitted to the tissues does not create heat within the cells, nor cause the cells' atoms to vibrate much causing a thermal increase, nor cause an electron to jump to a higher orbit and emit heat as it returns to its orbit of origin.

ADP



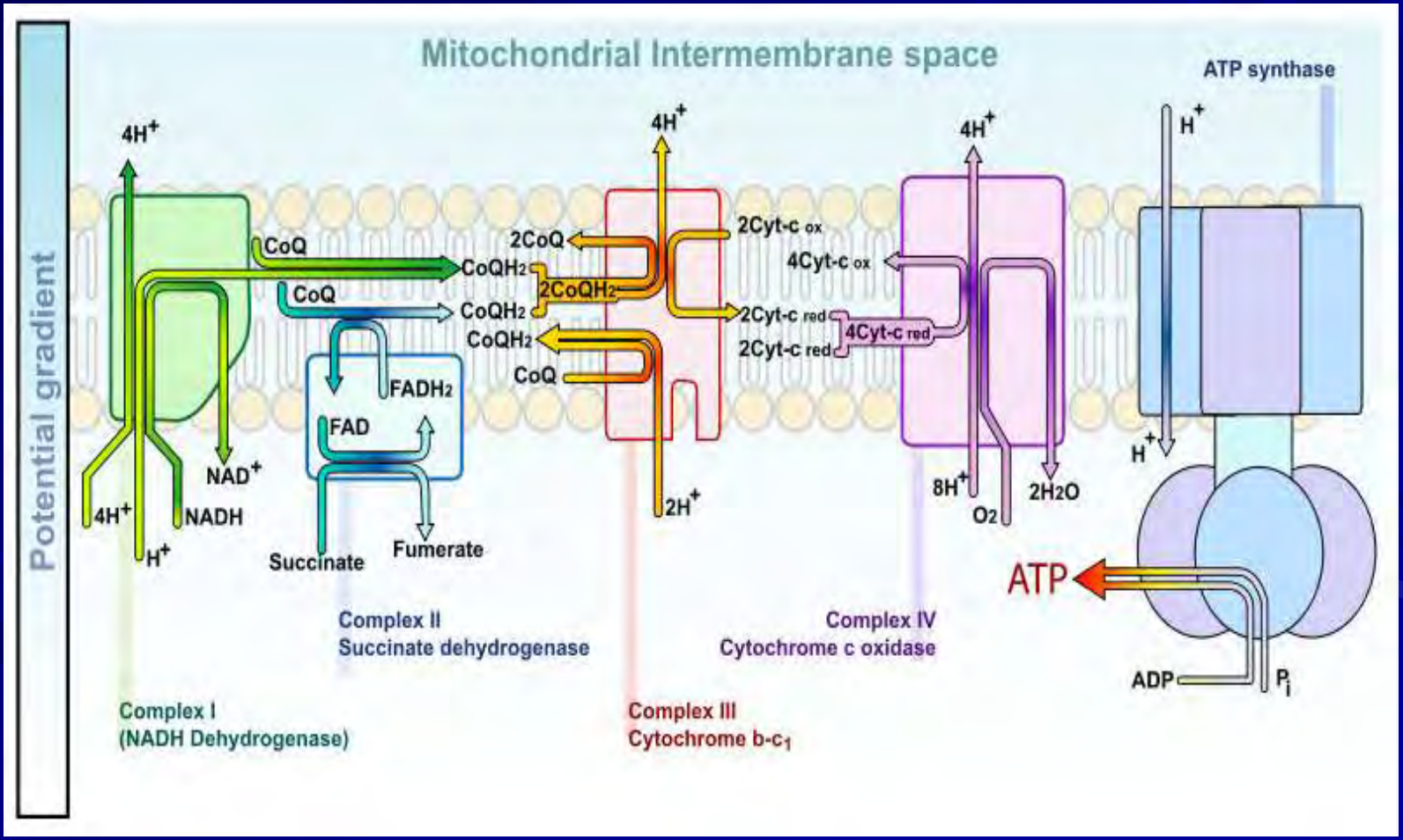
ATP



There is only sufficient average energy for the electron-spin to be increased, thus, energy gets stored in the cells' mitochondria by converting ADP (Adenosine Di-Phosphate) to ATP molecules more rapidly by the addition of the phosphate radical to the ADP.

The ATP molecules store and transport the energy that is then used in the many chemical processes within the cell that participate in all the metabolic functions of living cells.

This phenomenon is referred to as the *electron transport chain* and is described in the diagrams below.



The crisis of low energy is reflected in the following general chain reactions and results :

- low transmembrane potential
- increased accumulation of sodium ions inside the cell : Hypernatremia
- increased water molecules attached to sodium molecules inside the cell associated to hypernatremia
- inflammation
- increased volume of the cell and osmotic pressure inside the cell, damaging
- the cell membrane
- swelling of cell, followed by thinning of the cell membrane
- cell division

The above conditions further obstruct cell metabolism. When transmembrane potential drops below 15 mvolts, it leads to cell division and eventually causes cancerous cells to over populate.

So, we see naturally why the tumor grows or diffuses to adjacent areas and tissues, **a phenomenon known as "cancer diffusion"**, i.e., cancers ability to diffuse to adjacent healthy cells and tissues.

Fundamental principle for cancer in relation to the physical energy condition of a cell.

Cancer , is a critically low state of energy within a cell and with a critically low metabolism , in which the cell is being "trapped" for various reasons.

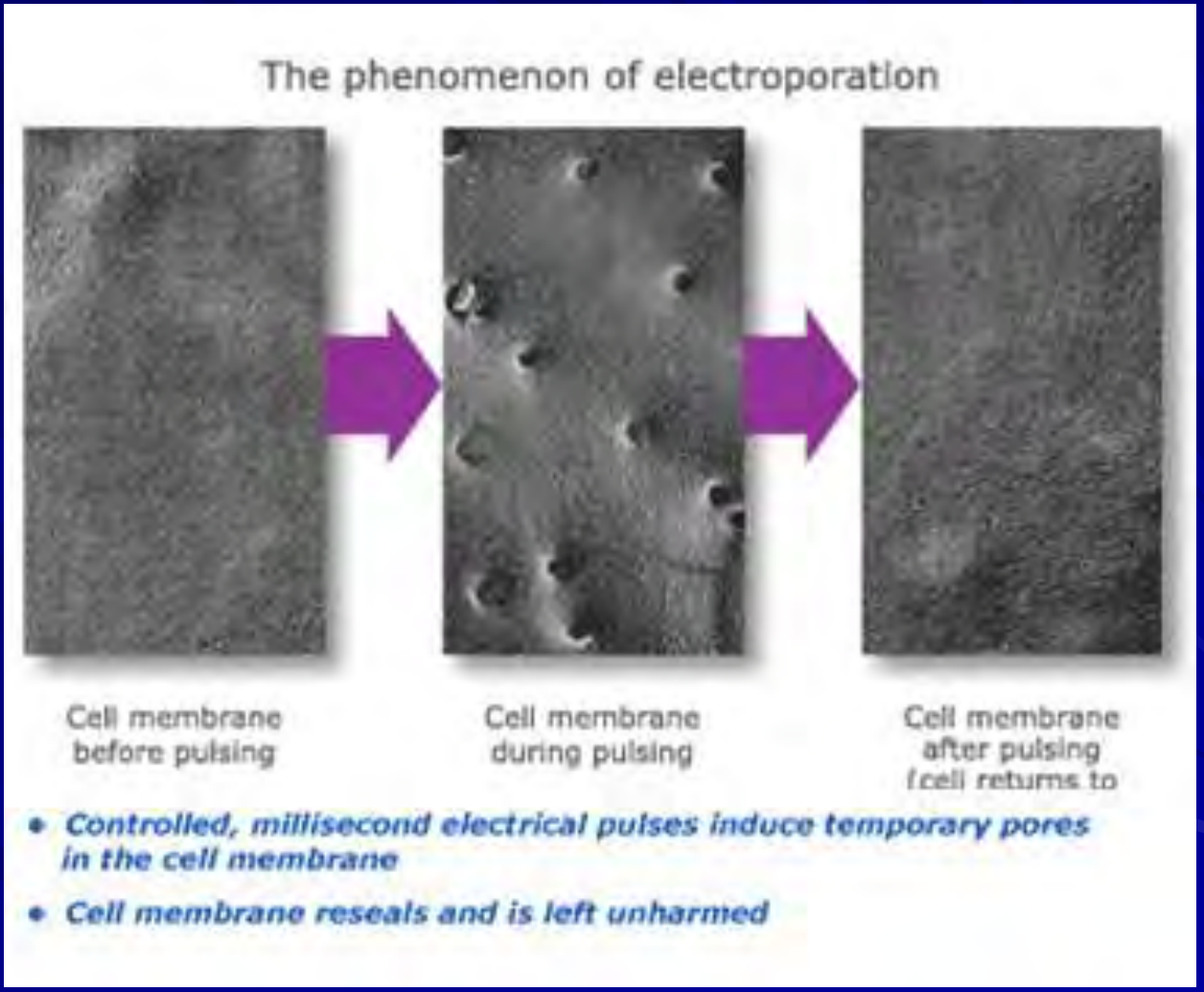
This critically low energy and metabolism state is manifested by a low transmembrane potential (TMP) of 15 mvolts, which causes a "chain " of specific malfunctions for the cell, and a general state of ischemia (low energy) for the organism .

When a cell is in this particular low energy/metabolism state and has below TMP of 15 mvolts that is responsible for cell metabolism (Nobel Laureate Albert Szent-Gyorgyi, Cone and others). The extremely weak TMP of 15 mvolts cell divides in two identical parts in an attempt to survive in larger numbers as a species.

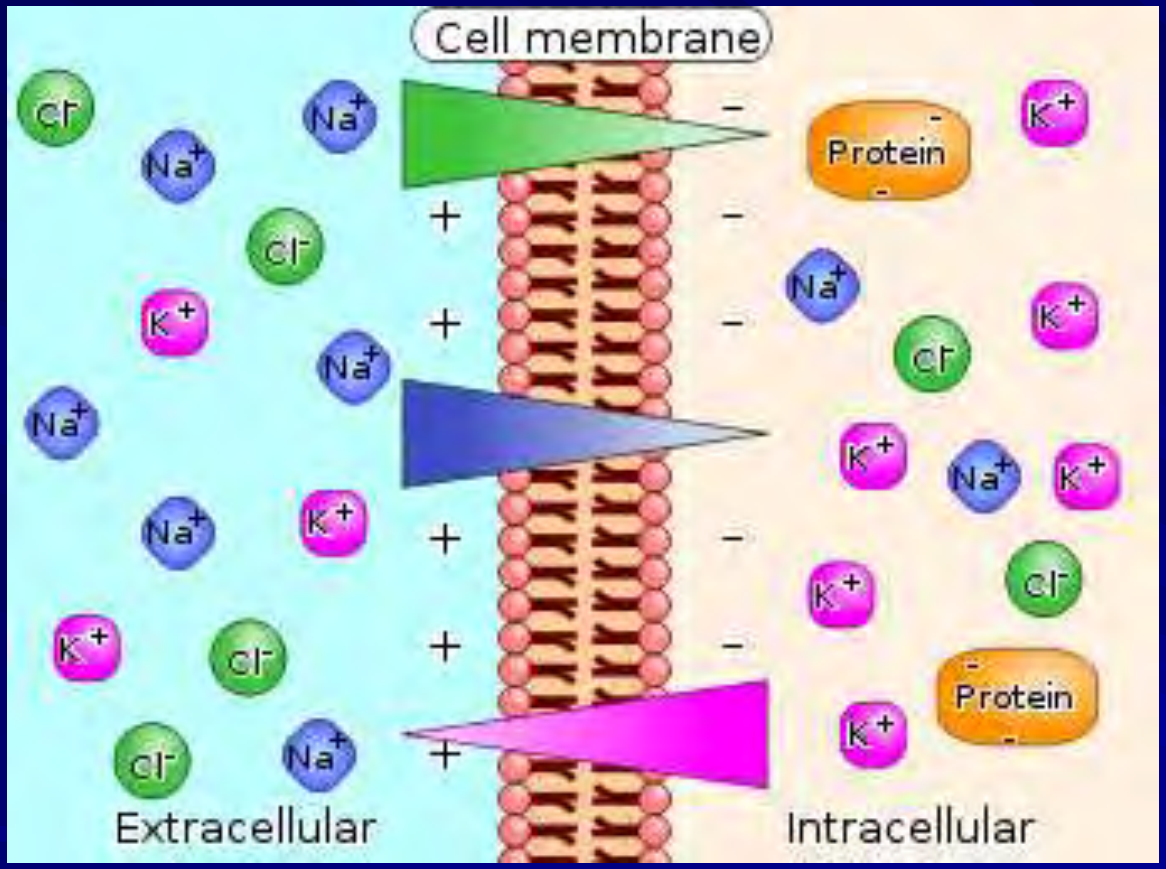
PEMF induces Electro-poration – Increasing Cellular (TMP) Transmembrane Potential

Applied PEMF stimulates electroporation of the cell membrane, where tiny pores or "ion channels" are opened during pulses.

This effect increases trans-membrane potential, electron transport, and free radical scavenging, which is significantly important for anti-agine and treating chronic diseases including cancer.



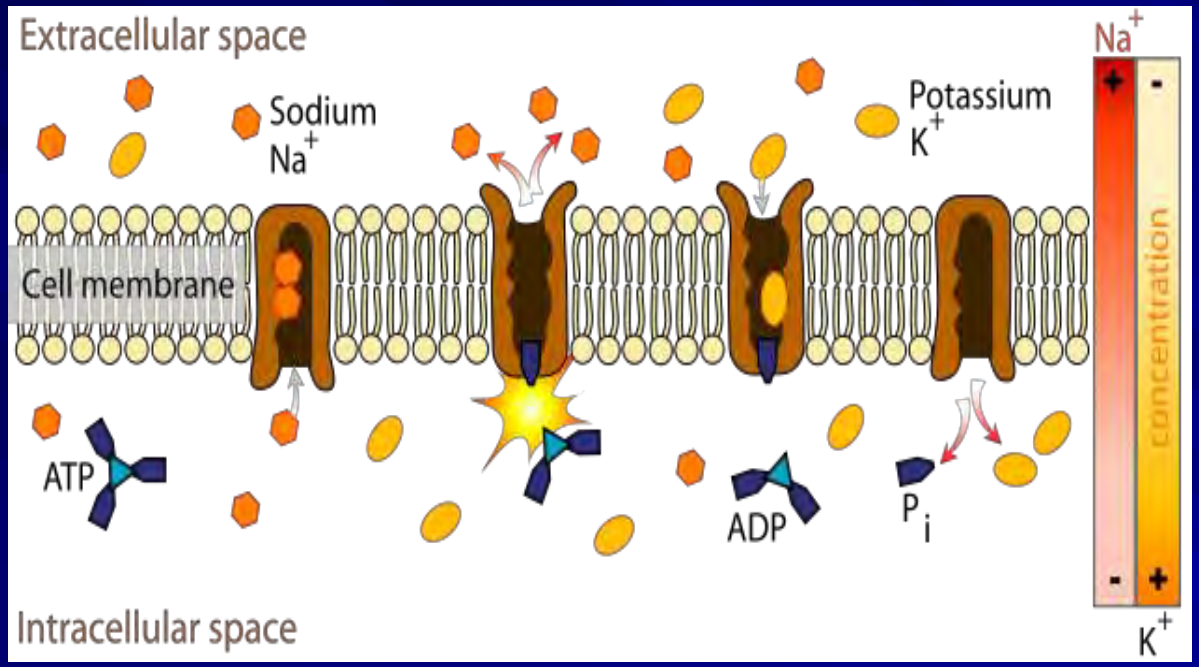
TMP - transmembrane potential is the difference in voltage (or electrical potential difference) between the interior and exterior of a cell (*V*interior − *V*exterior).



The membrane potential has two basic functions. First, it allows a cell to function as a battery, providing power to operate a variety of "molecular devices" embedded in the membrane. Second, in electrically excitable cells such as neurons, it is used for transmitting signals between different parts of a cell. Opening or closing of ion channels at one point in the membrane produces a local change in the membrane potential, which causes electric current to flow rapidly to other points in the membrane.

Differences in concentration of ions on opposite sides of a cellular membrane produce a voltage difference called the membrane potential. The largest contributions usually come from sodium (Na+) and chloride (Cl–) ions which have high concentrations in the extracellular region, and potassium (K+) ions, which along with large protein anions have high concentrations in the intracellular region. http://en.wikipedia.org/wiki/Membrane_potential

In a study on Chronic Fatigue Syndrome and Electro-medicine, Thomas Valone, Ph.D, showed that **damaged or diseased cells present an abnormally low TMP, about 80% lower than healthy cells.** This signifies a greatly reduced metabolism and, in particular, impairment of the electrogenic Na+/ K+ pump activity associated with reduced ATP (Adenosine Tri-Phosphate) production.



The Na+/ K+ pump within the membrane forces a ratio of 3Na+ ions out of the cell for every 2K+ ions pumped in for proper metabolism. The sodium-potassium pump uses energy derived from ATP to exchange sodium for potassium ions across the membrane.

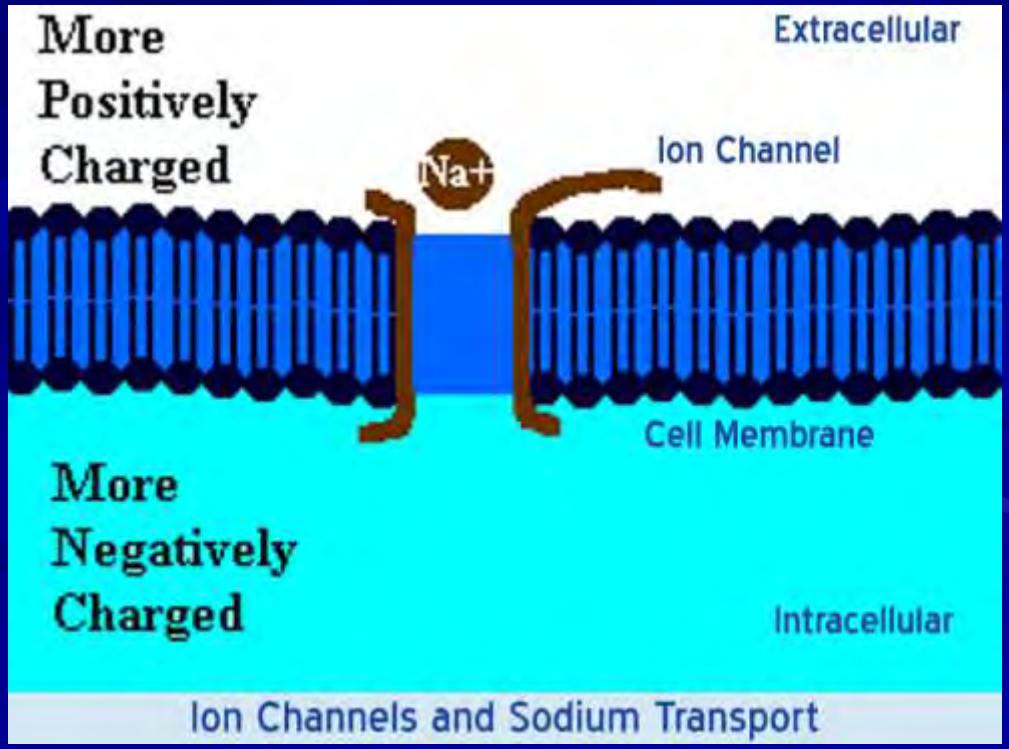
An impaired Na+/ K+ pump results in edema (cellular water accumulation) and a tendency toward fermentation, a condition known to be favorable toward cancerous activity.

In electrically excitable cells such as neurons, the TMP is used for transmitting signals from one part of a cell to another.

In non-excitable cells, and in excitable cells in their baseline states, the TMP is held at a relatively stable value, called the resting potential.

For neurons, typical values of the resting potential range from -70 to -80 mV (mill Volts); that is, the interior of a cell has a negative baseline voltage. Each axon has its characteristic resting potential voltage and in each case the inside is negative relative to the outside.

Opening and closing of ion channels can induce a departure from the resting potential, called a depolarization if the interior voltage rises (say from -70 mV to -65 mV), or a hyper polarization if the interior voltage becomes more negative (for example, changing from -70 mV to -80 mV).
Special types of voltage-dependent ion channels that generate action potentials but remain closed at the resting TMP can be induced to open by a small depolarization.



PEMF Therapy Increases Cellular Membrane Permeability and Cellular Metabolism

As early as 1940, it was suggested that magnetic fields affect the TMP and the flow of ions in and out of the cells and might therefore influence cellular membrane permeability.

It has since been established that magnetic fields can influence ATP (Adenosine Tri-phosphate) production; increase the supply of oxygen and nutrients via the vascular and lymphatic systems; improve the removal of waste via the lymphatic system; and help re-balance the distribution of ions across the cell membrane.

Healthy cells in tissue have a voltage difference between the inner and outer membrane referred to as the membrane resting potential that ranges from -70 to -80 mV. This causes a steady flow of ions through its voltage-dependant ion channels.

As the magnetic field created fluctuates, it induces an electron flow or a current in one direction through the living tissue. As electrons always flow from a negative (cathode) to a positive (anode) potential, when the magnetic field vanishes, the direction of the electron flow is reversed. Therefore such induced polarized currents stimulate the exchange of ions across the cell membrane.

Physiol Meas. 2004 Aug;25(4):1077-93.

Nanosecond pulsed electric fields modulate cell function through intracellular signal transduction mechanisms.

Beebe SJ, Blackmore PF, White J, Joshi RP, Schoenbach KH.

Center for Pediatric Research, Eastern Virginia Medical School, Children's Hospital for The King's Daughters, Norfolk, VA, USA.

These studies describe the effects of nanosecond (10-300 ns) pulsed electric fields (nsPEF) on mammalian cell structure and function. As the pulse durations decrease, effects on the plasma membrane (PM) decrease and effects on intracellular signal transduction mechanisms increase.

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NsPEF with durations and electric field intensities that do or do not cause PM electroporation, induce apoptosis in mammalian cells with a well-characterized phenotype typified by externalization of phosphatidylserine on the outer PM ar activation of caspase proteases.

Treatment of mouse fibrosarcoma tumors with nsPEF also results in apoptosis induction. When Jurkat cells were transfected by electroporation and then treated with nsPEF, green fluorescent protein expression was enhanced compared to electroporation alone.

The results indicate that nsPEF activate intracellular mechanisms that can determine cell function and fate, providing an important new tool for probing signal transduction mechanisms that modulate cell structure and function and for potential therapeutic applications for cancer and gene therapy.

PMID:15382843 [PubMed - indexed for MEDLINE]

Alternating electric fields arrest cell proliferation in animal tumor model and human brain tumors

Yale University School of Medicine, New Haven, CT, April 5, 2007

We have recently shown that low intensity, intermediate frequency, electric fields inhibit by an anti-microtubule mechanism of action, cancerous cell growth *in vitro*. Using implanted electrodes, these fields were also shown to inhibit the growth of dermal tumors in mice. The present study extends these findings to additional cell lines [human breast carcinoma; MDA-MB-231, and human non-small-cell lung carcinoma (H1299)] and to animal tumor models (intradermal B16F1 melanoma and intracranial F-98 glioma) using external insulated electrodes. These findings led to the initiation of a pilot clinical trial of the effects of TTFields in 10 patients with recurrent glioblastoma (GBM). Median time to disease progression in these patients was 26.1 weeks and median overall survival was 62.2 weeks. These time to disease progression and OS values are more than double the reported medians of historical control patients. No device-related serious adverse events were seen after >70 months of cumulative treatment in all of the patients. The only device-related side effect seen was a mild to moderate contact dermatitis beneath the field delivering electrodes.

We conclude that TTFields are a safe and effective new treatment modality which effectively slows down tumor growth *in vitro*, *in vivo* and, as demonstrated here, in human cancer patients.

Technol Cancer Res Treat. 2011 Jun;10(3):281-6.

Differential sensitivities of malignant and normal skin cells to nanosecond pulsed electric fields.

Yang W, Wu YH, Yin D, Koeffler HP, Sawcer DE, Vernier PT, Gundersen MA.
Ming Hsieh Department of Electrical Engineering, Viterbi School of Engineering (VSoE), University of Southern California (USC), Los Angeles, CA 90089, USA.

Abstract

Pulsed electric fields with nanosecond duration and high amplitude have effects on biological subjects and bring new venue in disease diagnosis and therapy. To address this respect, we investigated the responses of paired tumor and normal human skin cells - a basal cell carcinoma (BCC) cell line, and its sister normal cell line (TE) - to nanosecond, megavolt-per-meter pulses. When BCC (TE 354.T) and TE (TE 353.SK) cells, cultured under standard conditions, were exposed to 30 ns, 3 MV/m, 50 Hz pulses and tested for membrane permeabilization, viability, morphology, and caspase activation, we found that nanoelectropulse exposure: 1) increased cell membrane permeability in both cell lines but to a greater extent in BCC cells than in normal cells; 2) decreased cell viabilities with BCC cells affected more than normal cells; 3) induced morphological changes in both cell lines including condensed and fragmented chromatin with enlarged nuclei; 4) induced about twice as much caspase activation in BCC cells compared to normal cells.

We concluded that in paired tumor and normal skin cell lines, the response of the tumor cells to nanoelectropulse exposure is stronger than the response of normal cells, indicating the potential for selectivity in therapeutic applications.

PMID:21517135 [PubMed - in process]

Exercise Alters Epigenetics

TheScientist
MAGAZINE OF THE LIFE SCIENCES

Exercise causes short-term changes in DNA methylation and gene expression in muscle tissue that may have implications for type 2 diabetes.

By Hannah Waters | March 6, 2012

Exercise can delay the onset of diabetes by boosting the expression of genes involved in muscle oxidation and glucose regulation. A new study, published on March 6th in *Cell Metabolism*, suggests that DNA methylation drives some of these changes, and that they can occur within just a few hours of exercise, providing a potential mechanism for how exercise protects the body from metabolic disease.

People with type 2 diabetes are less responsive to insulin than healthy individuals, and thus have difficulties maintaining normal blood sugar levels. Certain metabolic genes, such as those involved in glucose transport and mitochondrial regulation, have been shown to be expressed at lower levels in diabetics, possibly explaining their decreased insulin responsiveness.

"Exercise is one therapeutic to maintain sensitivity of the organs to insulin and prevent diabetes," said molecular physiologist Juleen Zierath of the Karolinska Institute, who in 2009 showed that diabetics have different DNA methylation patterns in muscle. This suggested "there might be some dynamic changes in methylation" after exercise, said Zierath, who teamed up with Romain Barres of Copenhagen University and others to further investigate a possible epigenetic mechanism of exercise-induced diabetes prevention.

http://the-scientist.com/2012/03/06/exercise-alters-epigenetics/

HEALTHbeat

June 23, 2012

HARVARD MEDICAL SCHOOL

Trusted advice for a healthier life

Natural "exercise" hormone transforms fat cells

Exercise makes cells burn extra energy—that's one way it helps control weight. It also generates a newly discovered hormone, called irisin, that transforms energy-storing white fat cells into energy-burning brown fat cells. Irisin also appears to help prevent or overcome cellular changes that lead to type 2 diabetes.

"Irisin travels throughout the body in the blood and alters fat cells," explains Dr. Anthony Komaroff, editor in chief of the *Harvard Health Letter*, in the June 2012 issue. "If your goal is to lose weight, you want to increase the number of brown fat cells and decrease white fat cells."

Fat "color" makes a difference

White adipose tissue, more commonly known as body fat, is the tissue that dimples thighs, enlarges waists and derrieres, and pads internal organs. Each white fat cell stores a large droplet of fat. Brown fat, in comparison, is chock full of energy-burning mitochondria. Its main function is to generate body heat by burning fat.

http://www.health.harvard.edu/newsletters/Harvard_Health_Letter/2012/June/major-fat-burning-discovery

Plant Physiol. 2007 January; 143(1): 291–299.

Degradation of Oxidized Proteins by Autophagy during Oxidative Stress in Arabidopsis

Yan Xiong, Anthony L. Contento, Phan Quang Nguyen, and Diane C. Bassham*

PubMed.gov
U.S. National Library of Medicine
National Institutes of Health

Upon encountering oxidative stress, proteins are oxidized extensively by highly reactive and toxic reactive oxidative species, and these damaged, oxidized proteins need to be degraded rapidly and effectively. There are two major proteolytic systems for bulk degradation in eukaryotes, the proteasome and vacuolar autophagy. In mammalian cells, the 20S proteasome and a specific type of vacuolar autophagy, chaperone-mediated autophagy, are involved in the degradation of oxidized proteins in mild oxidative stress.

Using two macroautophagy markers, monodansylcadaverine and green fluorescent protein-AtATG8e, we here show that application of hydrogen peroxide or the reactive oxidative species inducer methyl viologen can induce macroautophagy in Arabidopsis (*Arabidopsis thaliana*) plants. Macroautophagy-defective RNAi-*AtATG18a* transgenic plants are more sensitive to methyl viologen treatment than wild-type plants and accumulate a higher level of oxidized proteins due to a lower degradation rate. In the presence of a vacuolar H+-ATPase inhibitor, concanamycin A, oxidized proteins were detected in the vacuole of wild-type root cells but not RNAi-*AtATG18a* root cells.

Together, our results indicate that autophagy is involved in degrading oxidized proteins under oxidative stress conditions in Arabidopsis.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1761971/

Exercise as Housecleaning for the Body

By GRETCHEN REYNOLDS, Columnist
New York Times
February 1, 2012

When ticking off the benefits of physical activity, few of us would include intracellular housecleaning. But a new study suggests that the ability of exercise to speed the removal of garbage from inside our body's cells may be one of its most valuable, if least visible, effects.

It's long been known that cells accumulate flotsam from the wear and tear of everyday living. Broken or misshapen proteins, shreds of cellular membranes, invasive viruses or bacteria, and worn-out, broken-down cellular components, like aged mitochondria, the tiny organelles within cells that produce energy, form a kind of trash heap inside the cell.

Through a process with the expressive name of autophagy, or "self-eating," cells create specialized membranes that engulf junk in the cell's cytoplasm and carry it to a part of the cell known as the lysosome, where the trash is broken apart and then burned by the cell for energy.

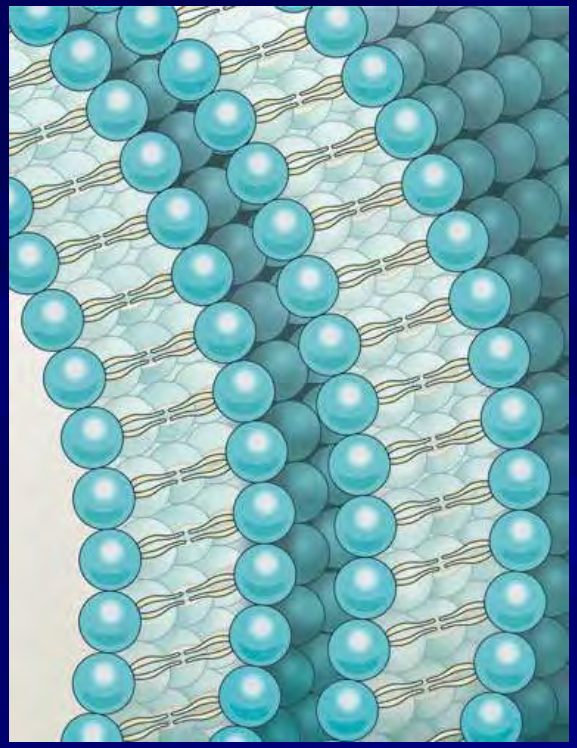
Without this efficient system, cells could become choked with trash and malfunction or die. In recent years, some scientists have begun to suspect that faulty autophagy mechanisms contribute to the development of a range of diseases, including diabetes, muscular dystrophy, Alzheimer's and cancer. The slowing of autophagy as we reach middle age is also believed to play a role in aging.

The Enigmatic Membrane

By Muriel Mari, Sharon A. Tooze, and Fulvio Reggiori

February 1, 2012

TheScientist
MAGAZINE OF THE LIFE SCIENCES

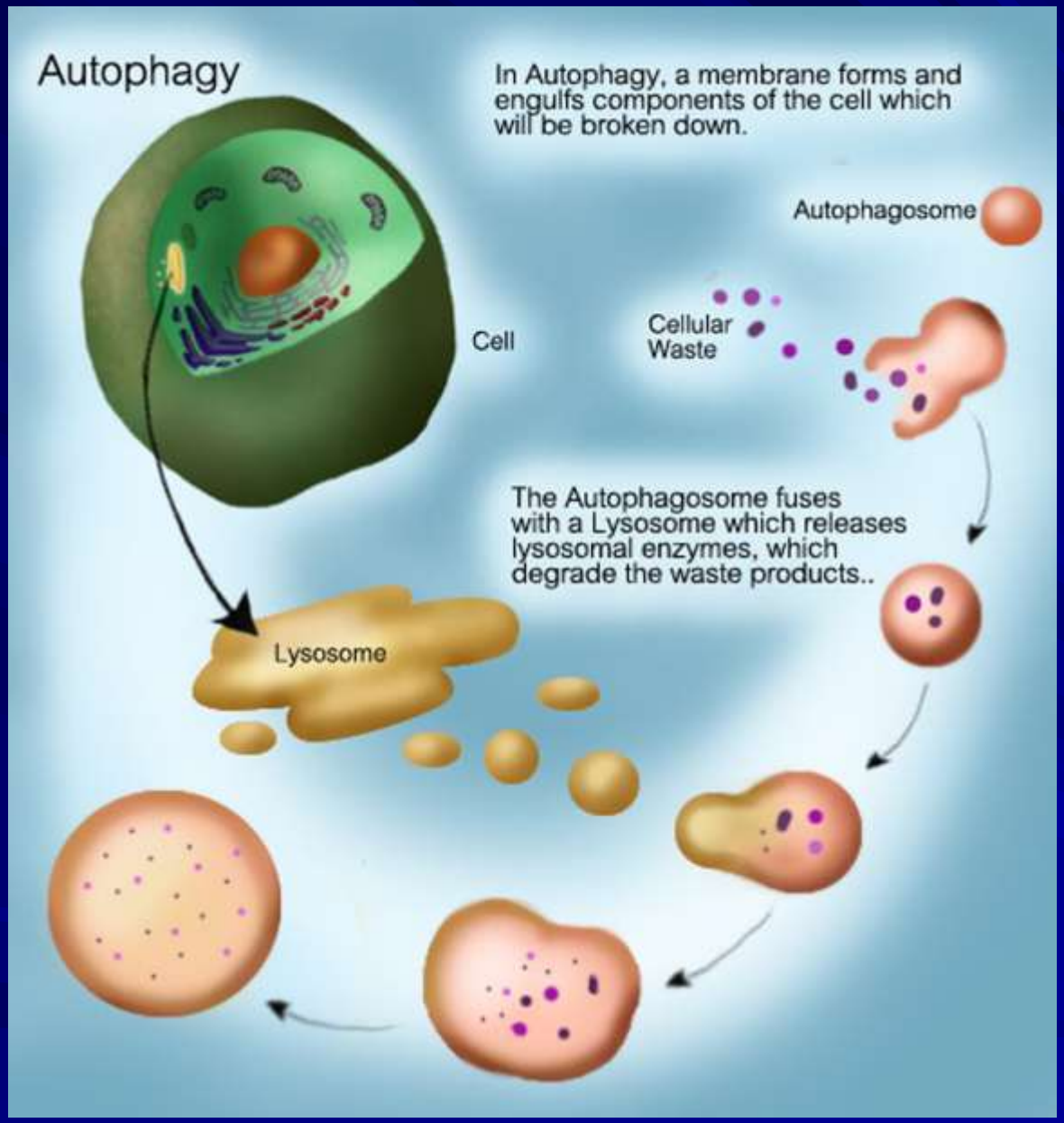


Cells live longer than their internal components. To keep their cytoplasm clear of excess or damaged organelles, as well as invading pathogens, or to feed themselves in time of nutrient deprivation, cells degrade these unwanted or potentially harmful structures, and produce needed food and fuel, using a process they have honed over millions of years known as **autophagy.**

This catabolic process involves the selection and the sequestration of the targeted structures into unique transport vesicles called autophagosomes, which then deliver the contents to lysosomes where they are degraded by lytic enzymes. This conserved eukaryotic pathway plays a central role in a multitude of physiological processes, including programmed cell death, development, and differentiation.

Autophagy plays a protective role against aging, tumorigenesis, neurodegeneration, and infection. Given all this, it is not surprising that an impairment of autophagy is correlated with various severe pathologies, including cardiovascular and autoimmune diseases, neuro- and myodegenerative disorders, and malignancies.

http://the-scientist.com/2012/02/01/the-enigmatic-membrane/



Recent developments reveal a crucial role for the autophagy pathway and proteins in immunity and inflammation. They balance the beneficial and detrimental effects of immunity and inflammation, and thereby may protect against infectious, autoimmune and inflammatory diseases.

Autophagy helps the cell fight infection by some kinds of invading bacteria and viruses, by cleaning them out of the cell's interior without having to discard the entire cell.

Sustained autophagy may also increase longevity by protecting cells against free radical damage and mutations in DNA.

http://www.mesaschumacher.com/science-art-and-illustration/medical-illustration/?album=6&gallery=24

*"**Autophagy** is the only way to get rid of damaged parts of the cell without trashing the whole thing. So in a nerve cell, for example, you'd want autophagy to correct problems without destroying the cell." ~* Daniel Klionsky, research professor at University of Michigan Life Sciences Institute

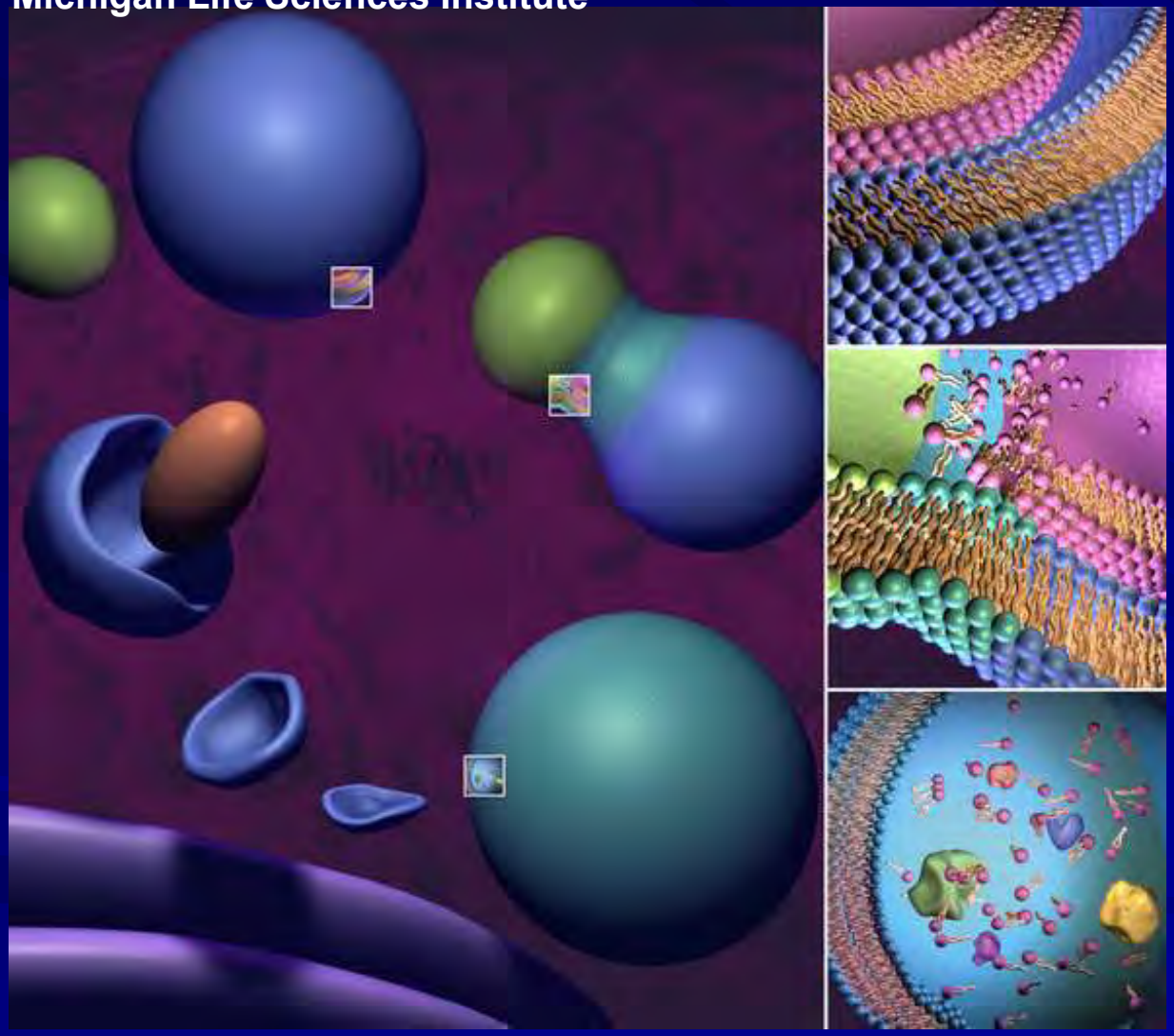


Image:Design by D.J. Klionsky and B.A. Rafferty, 3D Modeling and Rendering by B.A. Rafferty

Autophagy is the process by which cells recycle cytoplasm, proteins, and dispose of excess or defective organelles.

Cells form a double-membrane vesicle (blue) that sequesters cytosol and organelles (red oblong).

The resulting autophagosome fuses with the lysosome (green sphere), allowing the cargo to be broken down and reused, or disposed of.

Review Article
Journal of Molecular and Cellular Cardiology
Volume 51, Issue 4, October 2011, Pages 584–593

Autophagy as a therapeutic target in cardiovascular disease

Andriy Nemchenko, Mario Chiong, Aslan Turer, Sergio Lavandero, Joseph A. Hill

Abstract - The epidemic of heart failure continues apace, and development of novel therapies with clinical efficacy has lagged. Now, important insights into the molecular circuitry of cardiovascular autophagy have raised the prospect that this cellular pathway of protein quality control may be a target of clinical relevance.

Whereas basal levels of autophagy are required for cell survival, excessive levels – or perhaps distinct forms of autophagic flux – contribute to disease pathogenesis. Our challenge will be to distinguish mechanisms that drive adaptive versus maladaptive autophagy and to manipulate those pathways for therapeutic gain. Recent evidence suggests this may be possible.

Here, we review the fundamental biology of autophagy and its role in a variety of forms of cardiovascular disease. We discuss ways in which this evolutionarily conserved catabolic mechanism can be manipulated, discuss studies presently underway in heart disease, and provide our perspective on where this exciting field may lead in the future. This article is part of a special issue entitled "Key Signaling Molecules in Hypertrophy and Heart Failure."

http://www.sciencedirect.com/science/article/pii/S0022282811002483

Article by Martin Milner, ND featured in the May 2010 issue of Townsend Newsletter, along with article by Dr. Garry Gordon "Chelation and Cardiovascular Disease"

TOWNSEND LETTER – MAY 2010

Reversal of a Case of Advanced Coronary Artery Disease with Unstable Angina Using Pulsed Electromagnetic Field (PEMF) Cellular Exercise

by Martin Milner, ND

It is wonderful to both the patient and physician when, after years of failed trials in both conventional and alternative medicine, a safe, natural method of cellular exercise makes dramatic change in a case of serious chronic disease. This case is an extraordinary example of reversing end-stage coronary artery disease with pulsed electromagnetic field cellular exercise (PEMF). The case also elucidates critical monitoring and decision-making horizons throughout patient management.

The Case

SH, a 65-year-old, very pleasant white Caucasian female, presented to our clinic with advanced coronary artery disease, diabetes, hypertension, and obesity. Her cardiac history began in 1996, when she went into cardiac arrest and was successfully defibrillated and brought back to life. She did lose sensation in two of her toes at discharge from this hospitalization. This loss of sensation was presumed to be a complication of chest defibrillation. During this hospitalization, significant ischemic heart disease was diagnosed on cardiac catheterization, and two stents were deployed into the left anterior descending and right circumflex coronary artery.

Progression to Advanced Coronary Artery Disease

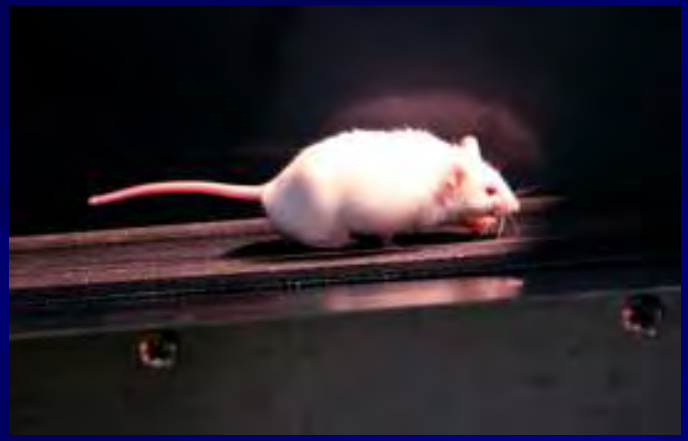
As time progressed, her disease advanced, and a second angiogram involved the deployment of a third stent in her left anterior descending coronary artery. Her ischemic heart disease progressed further, and in 2005 she underwent three vessel coronary artery bypass graph surgery where the LAD stents were bypassed along with bypass surgery of the left circumflex and bypassing a new occlusion in the right anterior descending coronary artery. At the time of this

Cellular Workout: Autophagy

The cell's recycling system, may be responsible for the health benefits of exercise.

By Megan Scudellari | January 18, 2012

TheScientist
MAGAZINE OF THE LIFE SCIENCES



It's indisputable—exercise is good for you. But on a molecular level, scientists aren't really sure why.

Published online today in *Nature,* researchers show that a cellular housekeeping mechanism, called autophagy, could be the source of the beneficial effects of exercise, including protection against diabetes.

Targeting the pathway could mimic the health effects of exercise—all the perks with none of the sweat—and help treat type II diabetes, the authors suggest.

Autophagy is an internal recycling system that degrades damaged or unwanted organelles and proteins in a cell and produces energy. In animal models, this process has been shown to protect against cancer, neurodegenerative disorders, infections, diabetes, and more. "Exercise is known to protect against all these same diseases," said Beth Levine, a biologist at the University of Texas Southwestern Medical Center, "so it made sense to us that exercise might induce autophagy."

Exercise Protects the Heart Via Nitric Oxide

Research , School of Medicine
May 4, 2011

Exercise both reduces the risk of a heart attack and protects the heart from injury if a heart attack does occur. For years, doctors have been trying to dissect how this second benefit of exercise works, with the aim of finding ways to protect the heart after a heart attack.

Researchers at Emory University School of Medicine have identified the ability of the heart to produce and store nitric oxide as an important way in which exercise protects the heart from injury.

Nitric oxide, a short-lived gas generated within the body, turns on chemical pathways that relax blood vessels to increase blood flow and activate survival pathways. Both the chemical nitrite and nitrosothiols, where nitric oxide is attached to proteins via sulfur, appear to act as convertible reservoirs for nitric oxide in situations where the body needs it, such as a lack of blood flow or oxygen.

In experiments with mice, the researchers showed that four weeks of being able to run on a wheel protected the mice from having a blocked coronary artery; the amount of heart muscle damaged by the blockage was less after the exercise period. Importantly, the mice were still protected a week after the wheel was taken away.

http://shared.web.emory.edu/whsc/news/releases/2011/05/exercise-protects-the-heart-via-nitric-oxide.html

PEMF Therapy and Nitric Oxide Production

Many cells in the body produce nitric oxide; however, its production by the vascular endothelium is particularly important in the regulation of blood flow. Abnormal production of nitric oxide, as occurs in different disease states, can adversely affect blood flow and other vascular functions. Nitric oxide is one of the few gaseous signaling molecules known and is additionally exceptional due to the fact that it is a radical gas. It is a key vertebrate biological messenger, playing a role in biological processes.

The March/April 2009 Aesthetic Surgery Journal published a study:

"Evidence-Based Use of Pulsed Electromagnetic Field Therapy in Clinical Plastic Surgery" that summarizes the evolution in the understanding of the physiological effects of PEMF therapy on cells and tissues.

Studies emerged suggesting that PEMF could modulate the production of growth factors and began to focus on enzyme systems with well-characterized calcium (Ca2+) dependence.

'If Physical Exercise Were a Drug, It Would Be Hitting the Headlines' ; Exercise Can Help Cancer Survivors, Says New Report

Macmillan Cancer Support - http://www.macmillan.org.uk

08-09-11

EXERCISE is a "wonder drug" for cancer survivors and may even prevent the disease coming back, according to a report published today. Macmillan Cancer Support said physical activity should be "prescribed" by doctors after "hard evidence" showed it can significantly help recovery and prevent other long-term illnesses.

The research also showed exercise had an impact on *preventing recurrence* of a few specific cancers.

- **Women with breast cancer who exercise for 150 minutes a week at moderate intensity have a more than 40% lower risk of dying and recurrence of disease compared to women who are active for less than one hour a week.**

- **Results of two studies on bowel cancer also show the risk of dying or the disease coming back is cut by about 50% in patients taking six hours a week of moderate intensity exercise.**

- **Prostate cancer patients have around a 30% lower risk of dying from the disease and a 57% lower rate of disease progression if they do three hours of moderate intensity exercise a week.**

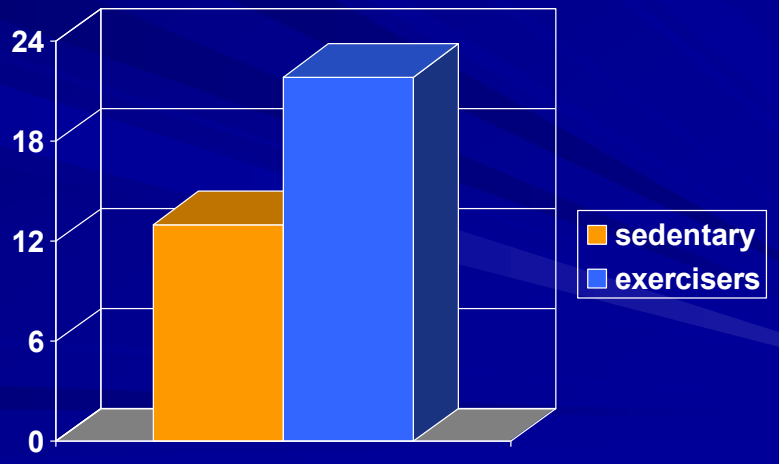
Exercise Associated With Longer Survival After Brain Cancer Diagnosis

ScienceDaily (June 21, 2011)

Brain cancer patients who are able to exercise live significantly longer than sedentary patients, scientists at the Duke Cancer Institute report.

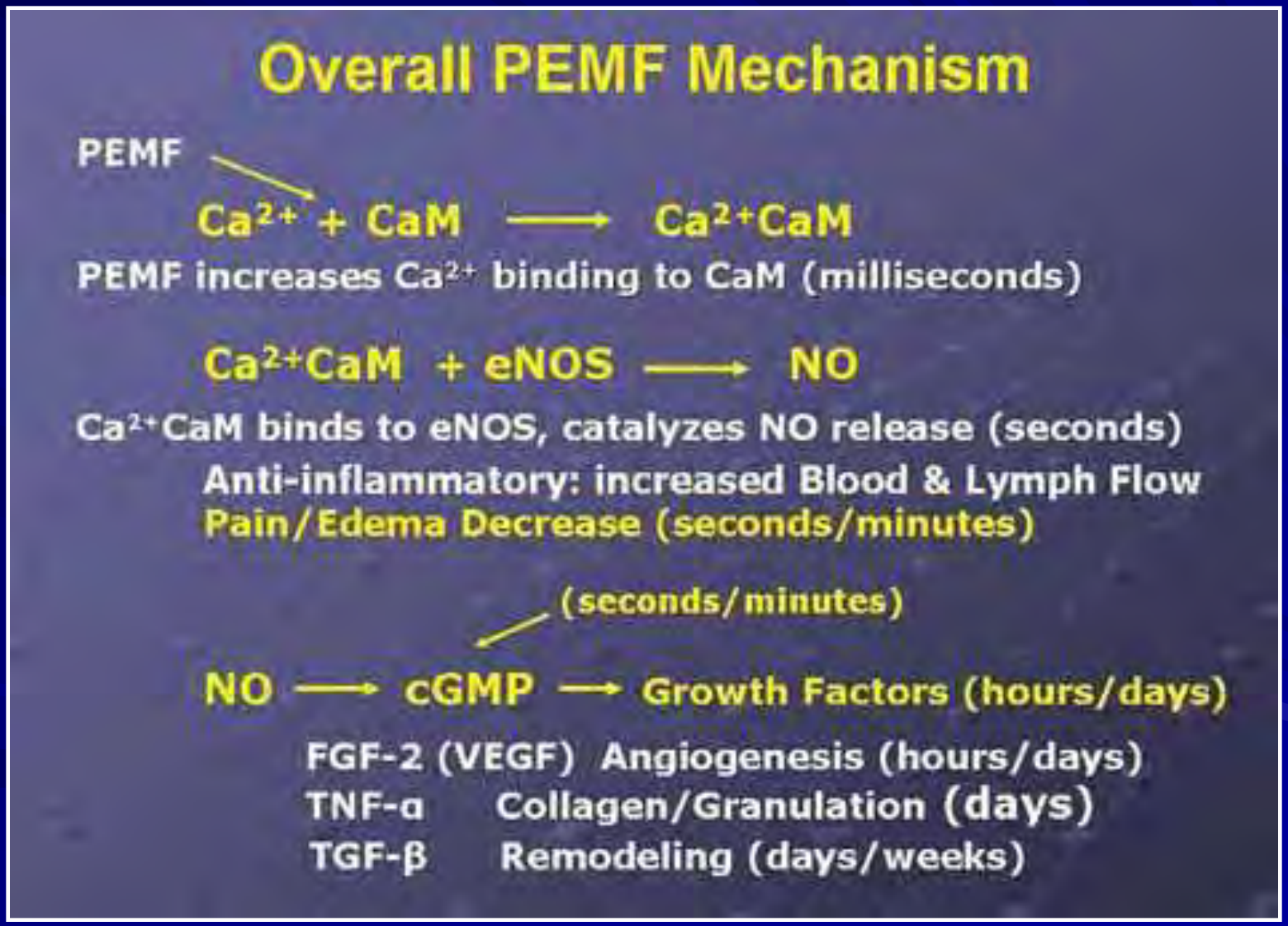
The finding, published online June 20 in the *Journal of Clinical Oncology*, adds to recent research that exercise improves how cancer patients feel during and after treatments, and may also extend their lives. The study enrolled 243 patients at the Preston Robert Tisch Brain Tumor Center at Duke with advanced recurrent gliomas, lethal brain malignancies that typically result in a median life expectancy of less than six months.

The patients who reported participating in regular, brisk exercise - the equivalent of an energetic walk five days a week for 30 minutes, had significantly prolonged survival, living a median 21.84 months vs. 13.03 months for the most sedentary patients.



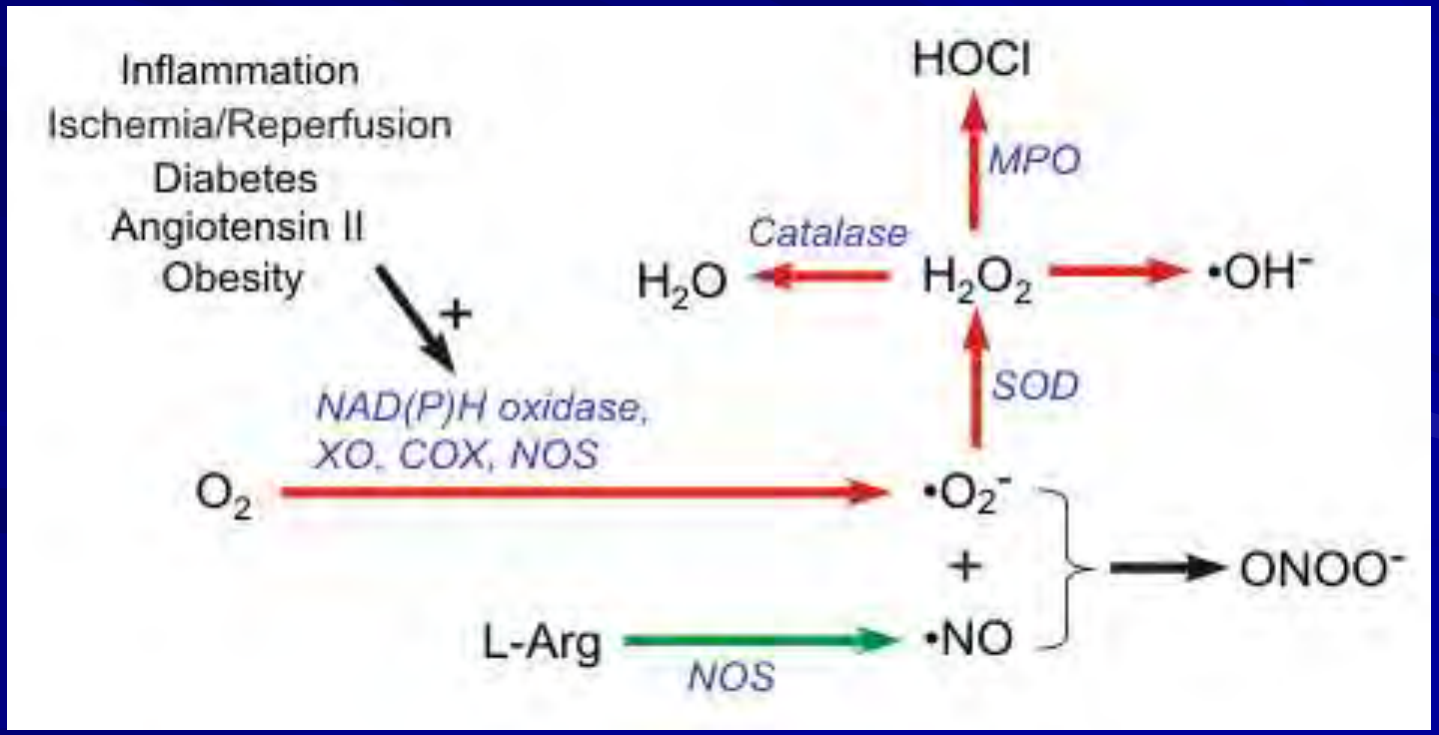
http://www.sciencedaily.com/releases/2011/06/110621114153.htm

As shown in the following diagram, this mechanism has been proposed as a working model for PEMF therapeutics.



Nitric oxide, known as the 'endothelium-derived relaxing factor', or 'EDRF', is biosynthesized endogenously from L-arginine, oxygen and NADPH by various nitric oxide synthase (NOS) enzymes. The endothelium (inner lining) of blood vessels uses nitric oxide to signal the surrounding smooth muscle to relax, thus resulting in vasodilation and increasing blood flow. Under normal conditions, nitric oxide is continually being produced by cNOS in the blood vessels.

The activity of iNOS is stimulated during inflammation by bacterial endotoxins or cytokines such as tumor necrosis factor (TNF) and interleukins. During inflammation, the amount of nitric oxide produced by iNOS may be a 1,000-fold greater than that produced by cNOS.

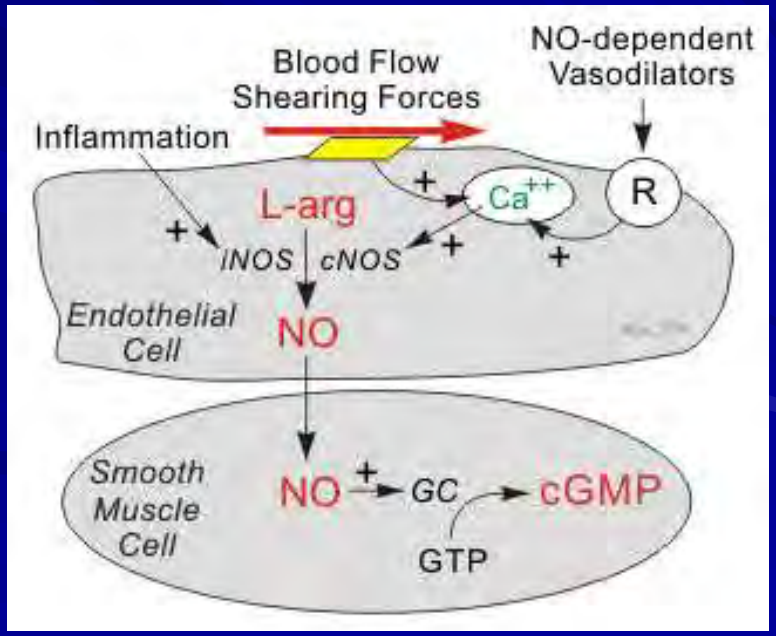


Intracellular Mechanisms

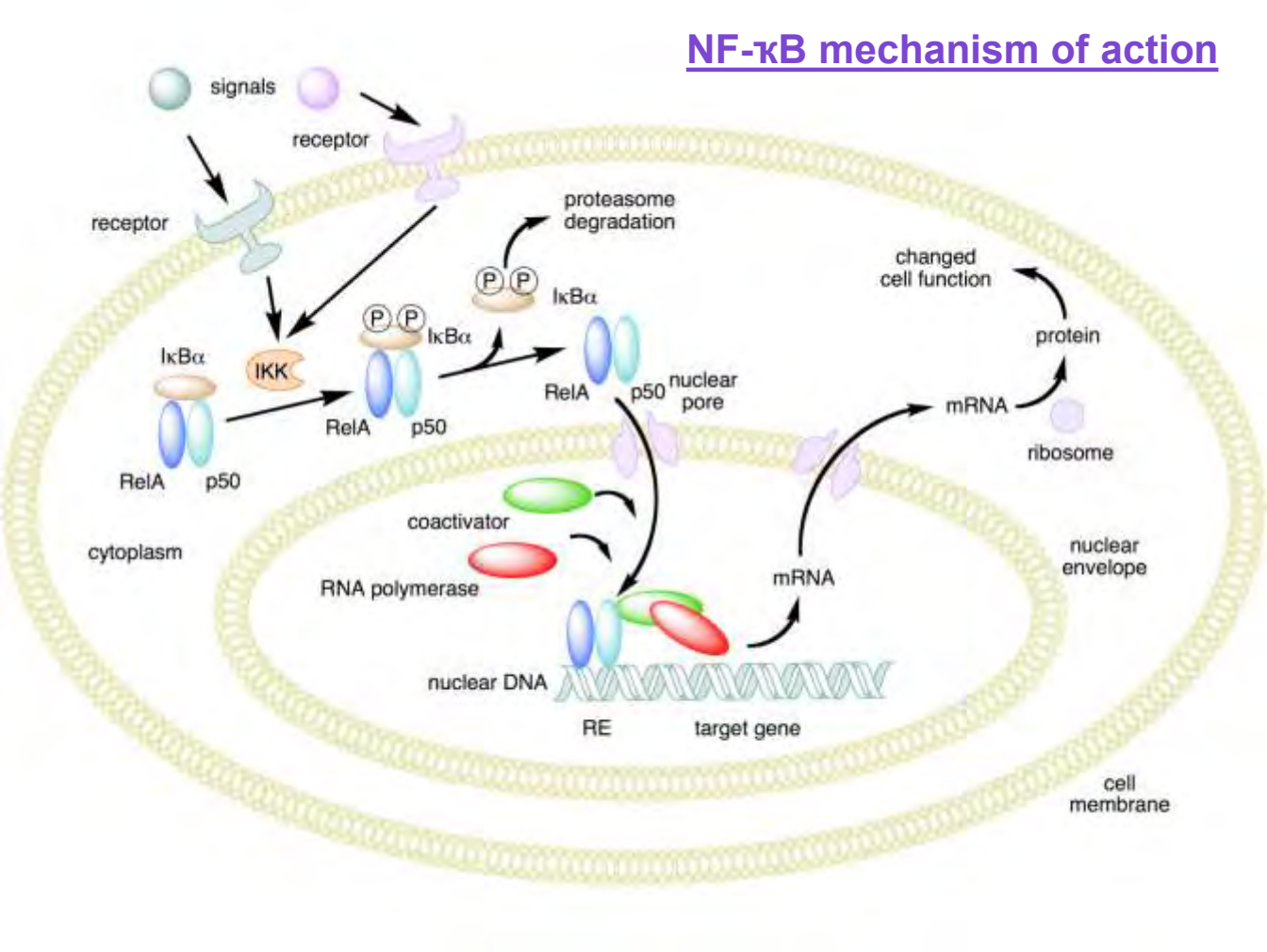
When nitric oxide forms, it is highly reactive (having a lifetime of a few seconds), yet diffuses freely across membranes, primarely because superoxide anion has a high affinity for nitric oxide. Superoxide and its products can have vasoactive activities in addition to their tissue damaging effects.

Nitric oxide also avidly binds to hemoglobin (in red blood cells) and the enzyme guanylyl cyclase, which is found in vascular smooth muscle cells and most other cells of the body. It also diffuses into the vascular smooth muscle cells adjacent to the endothelium where it binds to and activates guanylyl cyclase. This enzyme catalyzes the dephosphorylation of GTP to cGMP, which serves as a second messenger for many important cellular functions, particularly for signaling smooth muscle relaxation.

Because of the central role of cGMP in nitric oxide mediated vasodilation, drugs (e.g., Viagra®) that inhibit the breakdown of cGMP (cGMP-dependent phosphodiesterase inhibitors) are used to enhance nitric oxide mediated vasodilation, particularly in penile erectile tissue in the treatment of erectile dysfunction. Increased cGMP also has an important anti-platelet, anti-aggregatory effect. (*Cardiovascular Physiology Concepts by Richard E. Klabunde, PhD, published in 2005, www.cvphysiology.com updated in 2008*)



Nitric oxide is also generated by phagocytes (monocytes, macrophages, and neutrophils) and, as such, is part of the human immune response. Nitric oxide has been demonstrated to activate NF-κB in peripheral blood mononuclear cells, an important protein complex that controls the transcription of DNA and a transcription factor in iNOS gene expression in response to inflammation.



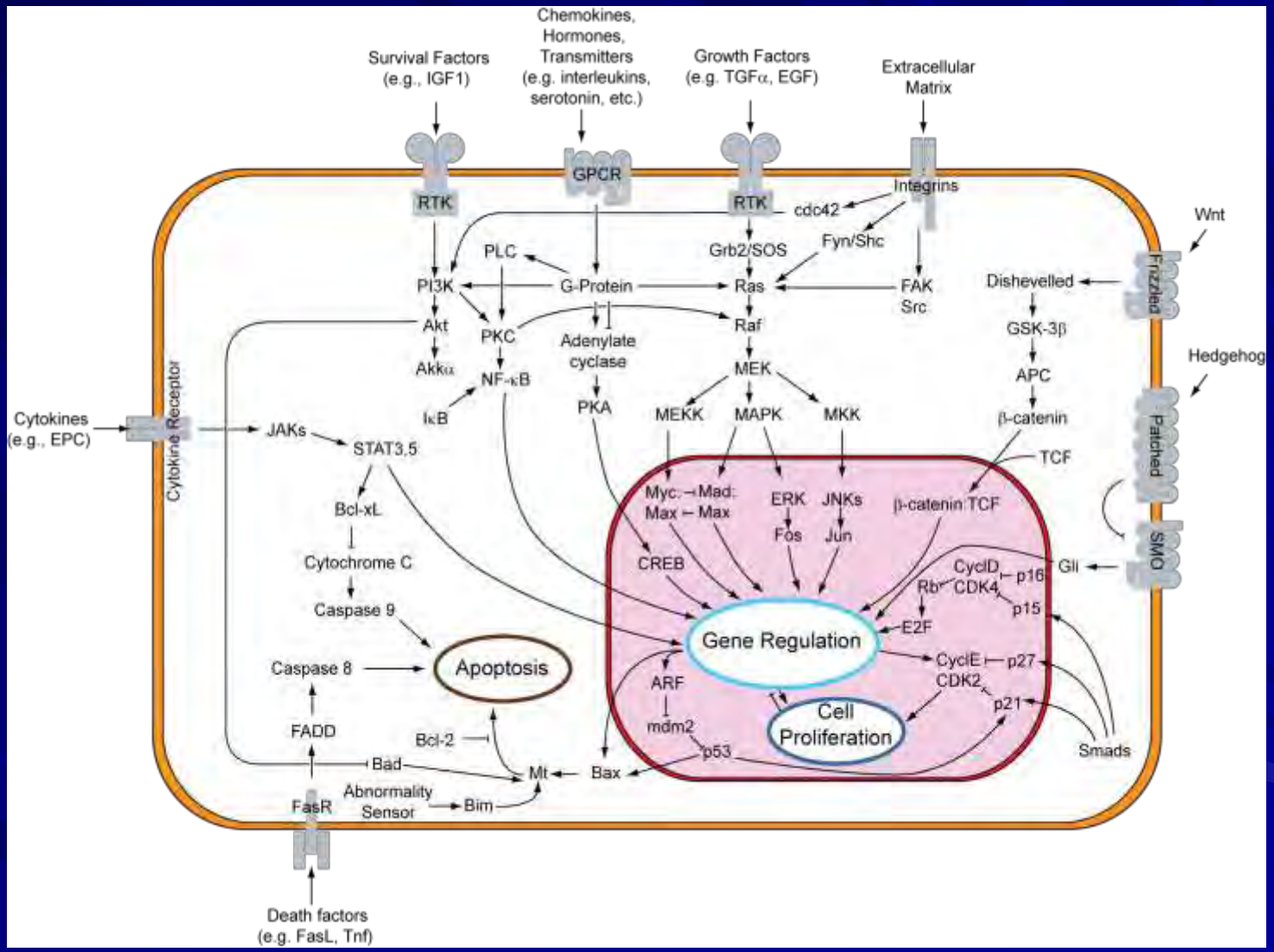
The Dynamics of Pain and PEMF Therapy

For most individuals, aside from the multiple benefits of the therapy, one of the most relevant effects of PEMF therapy is the improvement of painful conditions regardless of their origin. Pain mechanisms are complex and have peripheral and central nervous system aspects.

During the last 100 years, theories of pain mechanism have evolved from specificity and summation models to the popular Gate Control Theory. The latter pain theory, proposed by Melzack/Wall/Casey (*Wall and Melzack, 1989*) has become the most important development in the field of pain management. Pain perception is no longer a straightforward afferent transmission of pain signal.

In biology, signal transduction is a mechanism that converts a mechanical or chemical stimulus to a cell into a specific cellular response. Signal transduction starts with a signal to a receptor, and ends with a change in cell behavior. Transmembrane receptors move across the cell membrane, with half of the receptor outside the cell and the other half inside the cell. The signal, such as a chemical signal, binds to the outer half of the receptor, which changes its shape and conveys another signal inside the cell.

Overview of signal transduction pathways



Patient Money

Treating Chronic Pain and Managing the Bills

By MICHELLE ANDREWS

Published: February 4, 2011

The New York Times

"If you tally up everybody who has chronic, recurring back, headache and musculoskeletal problems, it includes *almost everybody* by the time people get into their 30s," said Dr. Perry Fine, a professor of anesthesiology at the Pain Research Center and the University of Utah and incoming chairman of the American Academy of Pain Medicine.

Given the prevalence of chronic pain — often defined as recurrent pain that lasts more than three to six months — you might expect that by now medical science would have figured out how to alleviate it and that health insurers would routinely cover its treatment.

If only it were that simple. Pain is a sneaky opponent. What one person considers intolerable may be only moderately uncomfortable to another. This makes treatment challenging. And insurers often do not make it any easier.

http://www.nytimes.com/2011/02/05/health/05patient.html

Magnetic Therapy and Migraine Headache; a pulsed electromagnetic field (PEMF) therapy and repetitive transcranial magnetic stimulation (rTMS/TMS)research bibliography.
http://www.earthpulse.net/migraine.htm

Pulsed magnetic fields beneficially affect migraine's abnormal brain electrophysiology, which is present to one extent or another in headache syndromes of all types. Extensive research suggests there are electrophysiological abnormalities that coexist with many different types of neurological disease states which can be positively affected by pulsed magnetic therapy including;

Alzheimer's, epilepsy, Parkinson's, cluster and other headache syndromes, severe PMS and other exaggerated menstrual related symptoms, insomnia and other sleeping disorders, attention deficit disorder ADD, attention deficit hyperactivity disorder ADHD, depression, schizophrenia and other psychological disorders.

Pulsed magnetic field research suggests that pulsed electromagnetic field therapy can reduce migraine as well as promote sleep and relaxation in insomniacs. Transcranial magnetic stimulation (TMS/rTMS) research has proven for decades that pulsed electromagnetic fields safely reduce anxiety and depression using magnetic fields that are hundreds, even thousands of times the magnetic field density used to produce deep, restful sleep and improved sense of wellbeing induced through EarthPulse™ magnetic field supplementation.

PEMF Therapy Reduces Pain

Many studies have demonstrated the positive effects of PEMF therapy on patients with pain, even as opposed to receiving traditional treatment as well as against a placebo group getting no treatment. Some studies focused on the rapid, short-term relief while others demonstrate the long-term effects. The effectiveness of PEMF therapy has been demonstrated in a wide variety of painful conditions.

In a March, 2003 publication on Pain Management with PEMF Treatment, Dr. William Pawluk explains:

> ***"Magnetic fields affect pain perception in many different ways. These actions are both direct and indirect. Direct effects of magnetic fields are: neuron firing, calcium ion movement, membrane potentials, endorphin levels, nitric oxide, dopamine levels, acupuncture actions and nerve regeneration. Indirect benefits of magnetic fields on physiologic function are on: circulation, muscle, edema, tissue oxygen, inflammation, healing, prostaglandins, cellular metabolism and cell energy levels… Short-term effects are thought due to a decrease in cortisol and noradrenaline, and an increase in serotonin, endorphins and enkephalins. Longer term effects may be due to CNS and/or peripheral nervous system biochemical and neuronal effects in which correction of pain messages occur; and the pain is not just masked as in the case of medication".***

PEMF Therapy Blocks Pain

PEMF therapy has shown to be effective at reducing pain both in the short-term and in the long-term. The ways by which PEMF therapy relieves pain include pain blocking, decreased inflammation, increased cellular flexibility, increased blood and fluids circulation, and increased tissue oxygenation.

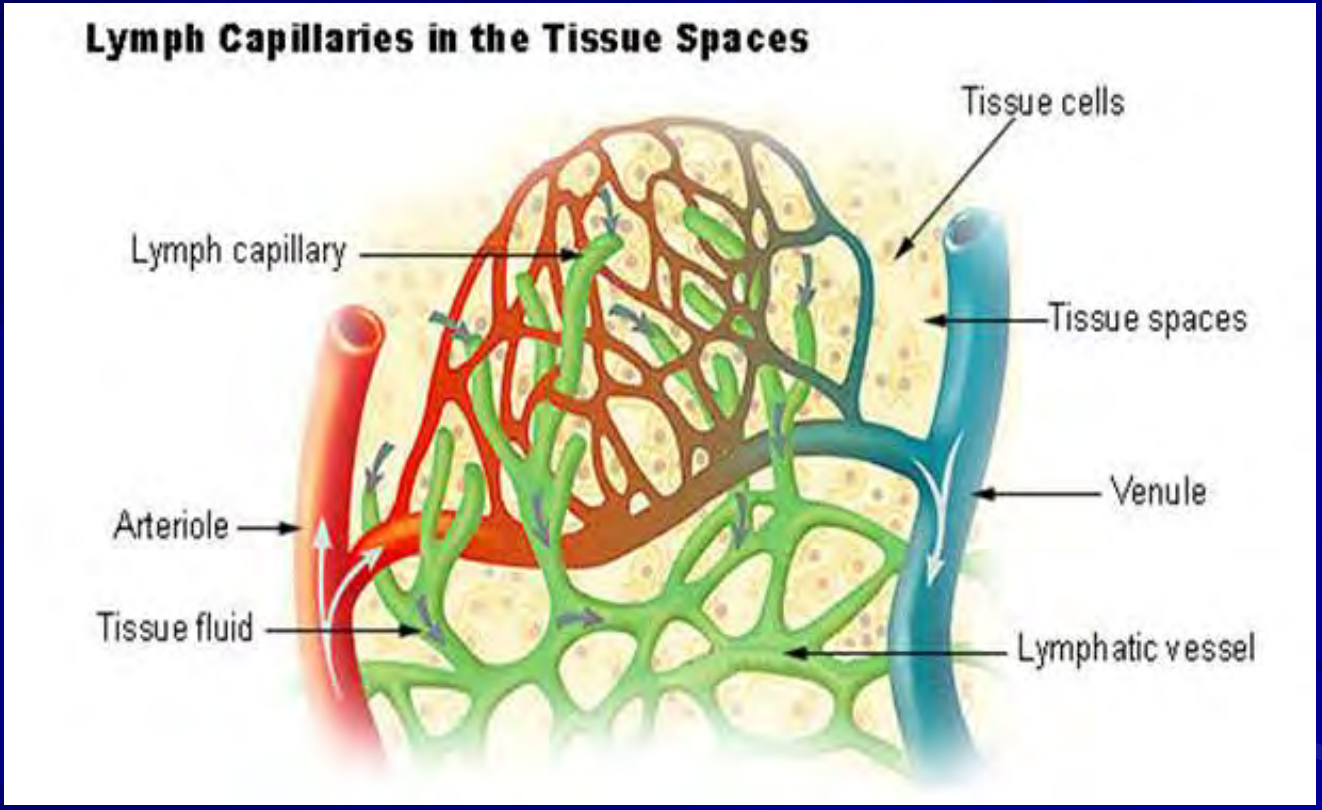
The trans-membrane potential, ("TMP") is the voltage difference (or electrical potential difference) between the interior and exterior of a cell. An electrochemical gradient results from a spatial variation of both an electrical potential and a chemical concentration across a membrane. Both components are often due to ion gradients, particularly proton gradients, and the result is a type of potential energy available for cellular metabolism. This can be calculated as a thermodynamic measure, an electrochemical potential that combines the concepts of energy stored in the form of chemical potential, which accounts for an ion's concentration gradient across a cellular membrane, and electrostatics, which accounts for an ion's tendency to move relative to the TMP.

Differences in concentration of ions on opposite sides of a cellular membrane produce the TMP.

PEMF Therapy Increases Blood and Lymphatic Circulation

The arterial and venal blood vessels are intimately associated with the lymphatic system.. As the blood and lymphatic vessels bring oxygen and nutrients to the cells and remove their waste products, they are nourishing and detoxifying the cells, tissues and body.

As PEMF therapy mechanically stimulates blood vessels and blood flow, the blood vessels pump blood and oxygen into the cells.



Simultaneously, PEMF therapy mechanically stimulates the lymphatic vessels and waste products are hauled away from the cells more efficiently. PEMF therapy supports immune health by mechanically stimulating lymphatic drainage and blood flow.

Evidence-based use of pulsed electromagnetic field therapy in clinical plastic surgery.

Strauch B, Herman C, Dabb R, Icznarro LJ, Pilla AA.
Albert Einstein College of Medicine, Bronx, NY, USA. bstrauch@montefiore.org

Abstract

Our objective was to review the major scientific breakthroughs and current understanding of the mechanism of action of PEMF therapy, providing clinicians with a sound basis for optimal use.

METHODS: A literature review was conducted, including mechanism of action and biologic and clinical studies of PEMF. Using case illustrations, a holistic exposition on the clinical use of PEMF in plastic surgery was performed.

RESULTS: PEMF therapy has been used successfully in the management of post surgicai pain and edema, the treatment of chronic wounds, and in facilitating vasodiiatation and angio-genesis. Using scientific support, the authors present the currently accepted mechanism of action of PEMF therapy.

CONCLUSIONS: This review shows that plastic surgeons have at hand a powerful tool with no known side effects for the adjunctive, noninvasive, nonpharmacologic management of postoperative pain and edema.

Given the recent rapid advances in development of portable and economical PEMF devices, what has been of most significance to the plastic surgeon is the laboratory and clinical confirmation of decreased pain and swelling following injury or surgery.

Effects of pulsed electromagnetic fields on postoperative pain: a double-blind randomized pilot study in breast augmentation patients.

Hedén P, Pilla AA. Department of Plastic Surgery, Akademikliniken, Storängsvägen 10, 115 42, Stockholm, Sweden. per.heden@ak.se

BACKGROUND: Postoperative pain may be experienced after breast augmentation surgery despite advances in surgical techniques which minimize trauma. The use of pharmacologic analgesics and narcotics may have undesirable side effects that can add to patient morbidity. This study reports the use of a portable and disposable noninvasive pulsed electromagnetic field (PEMF) device in a double-blind, randomized, placebo-controlled pilot study. This study was undertaken to determine if PEMF could provide pain control after breast augmentation.

METHODS: Forty-t\No healthy females undergoing breast augmentation for aesthetic reasons entered the study. They were separated into three cohorts, one group (n = 14) received bilateral PEMF treatment, the second group (n = 14) received bilateral sham devices, and in the third group (n = 14) one of the breasts had an active device and the other a sham device. A total of 80 breasts were available for final analysis.

RESULTS: VAS data showed that pain had decreased in the active cohort by nearly a factor of three times that for the sham cohort by POD 3 (p 0.001), and persisted at this ievel to POD 7. Patient use of postoperative pain medication correspondingly also decreased nearly three times faster in the active versus the sham cohorts by POD 3 (p 0.001).

CONCLUSION: Pulsed electromagnetic field therapy, adjunctive to standard of care, can provide pain control with a noninvasive modality and reduce morbidity due to pain medication after breast augmentation surgery.

PEMF Therapy Reduces Inflammation

Several factors may contribute to inflammation including injury, tissue damage, a poor localized circulation with the formation of edema. Inflammation causes pain. Swelling and bruising is an inflammation and discoloration of soft tissue caused by an impact injury or trauma. It can also result from surgery.

Tissue cells are inherently like tiny electrically charged machines. When a cell is traumatized, the cell's electrical charge is diminished; this causes normal cell functions and operations to shut down. Cells that are scarred or fibrotic with adhesions have a TMP charge of approximately -15 mV, degenerative or immune-compromised cells average -30 mV, both low TMPs.

With the raised TMP, the body releases chemical signals that cause inflammation swelling and bruising resulting in pain and inhibiting the cell communication pathways necessary for healing to begin. Numerous clinical studies have demonstrated that PEMF therapy has been successful in reducing inflammation.

PEMF therapy treats the cellular source of swelling by recharging the cells with a mild electromagnetic current. This stops the release of pain and inflammatory mediators, reduces inflammatory fluids and allows an increase in blood flow, therefore increased oxygen intake, to help the cells heal faster with less swelling, pain and bruising.

PEMF Therapy Increases Cellular Membrane Flexibility and Elasticity

A study entitled "Modulation of collagen production in cultured fibroblasts by a low-frequency pulsed magnetic field" by Murray *et al.* (*Biochim Biophys Acta)* shows that the total protein synthesis was increased in confluent cells treated with a pulsed magnetic field for the last 24 h of culture as well as in cells treated for a total of 6 days. However, in 6 day-treated cultures, collagen accumulation was specifically enhanced as compared to total protein, whereas after short-term exposure, collagen production was increased only to the same extent as total protein. These results indicate that a pulsed magnetic field can specifically increase collagen production, the major differentiated function of fibroblasts, possibly by altering cyclic-AMP metabolism.

PEMF therapy successfully increases membrane flexibility by increasing the synthesis of collagen, a crucial protein that supports membrane elasticity, within the fibroblasts. In doing so, PEMF therapy increases tissue and muscle flexibility and, in doing so, increases range of motion.

PEMF Therapy Increases Cellular Genesis (Cellular Growth and Repair)

The many intra and inter cellular processes and activity stimulated by PEMF therapy lead to faster cellular and tissue regeneration. This fact is shown by the results of many studies on a variety of tissues, including bones, spine, cartilage, intestines, blood vessels, nerves, brain, and muscles.

In December 2004, the Swiss Medical Tribune stated that PEMF therapy provided:

"improvement of blood circulation, relief from pain, improvement of bone healing and the stimulation of nerve cells. Not only is the PEMF therapy effective in disease condition: it is an excellent means of preventing stress, assisting regeneration and recovery after sports exertion… Through metabolic activation and blood circulation more nutrients and oxygen are available to muscle cells, less damage is experienced, and efficiency is improved."

This patient was diagnosed with parotid cancer and had surgery and radiation therapy in August of 2007. Following this, his face refused to heal. The side of his face stayed, pretty much as seen here for the next 3 1/2 years.

In late April, 2011, he started to apply PEMF to his face. 5 treatments and 2 weeks later, his face looked like this.

His face continues to improve with regular PEMF treatment sessions. The patient is, of course, very happy with the improvement in his face.

He is also very happy that the PEMF treatments have reduced the pelvic pain and frequent nighttime urination caused by an inflamed prostate!

Lassie Bit by Another Dog – Tissue Regeneration using PEMF

The bite injury interrupted the circulation to the leg causing tissue necrosis and removal of most of the leg.

PEMF treatments were given every other day - low intensity with butterfly at the top of the hip for 8 minutes, then midway down the leg...where the most growth of tissue and skin was needed for 3 minutes on medium intensity.

The morning after an evening treatment new skin and tissue growth appeared around the perimeter of the open wound, about the diameter of a piece of yarn.

Although it took awhile on this last section to fill in all the connective tissue and skin coverage, finally Lassie is back on her feet.

P R Health Sci J. 2008 Jun;27(2):175-9.

Elimination of a pressure ulcer with electrical stimulation--a case study.

Sosa IJ, Reves O, Kuffier DP.
Section of Neurological Surgery, University of Puerto Rico, San Juan, Puerto Rico.

Abstract

Pressure ulcers, also called decubitus ulcers, are a common challenge of humanity and are exceptionally difficult to heal. They are wounds that are initiated by relatively short periods of pressure on the skin that blocks blood circulation causing the skin and underlying tissues to die, leading to an open Wound. Pressure release can prevent further tissue degeneration, and some ulcers heal and disappear by themselves.

However, many pressure ulcers never heal and continue to grow in diameter and depth. By one year, such unhealing ulcers are referred to as chronic ulcers. Chronic ulcers frequently jeopardize the life of the patient due to infections that become increasingly deep until they invade bones and the circulatory system.

We report on a patient with a chronic pressure ulcer at his coccyx prominence. Fourteen months after the ulcer had appeared, a surface pulse electromagnetic force (PEMF) stimulator was applied over T7-T8, 45 cm cephalic to the ulcer, as part of a nerve stimulation study. Although the ulcer had continued to grow both in diameter and depth for 14 months and showed no signs of healing, within 6 days of applying the PEMF stimulator, the ulcer began to heal and was fully eliminated after 3 months.

We concluded that the electrical stimulation induced the healing of the pressure ulcer. The ulcer elimination is quite surprising due to the exceptionally low electric being generated by the stimulator at a distance of 45 cm.

Many Severe Diabetic Neuropathy Patients Have Their Scheduled Amputations Cancelled After Electrotherapy Treatments .

One Study In Mexico Saved 100% of the 87 Patients From Amputation…

December

January

February 4th

February 27th

This patient is diabetic. His right calf and ankle were very swollen and discolored and he had 2 toes amputated.

In early 2010 he developed a blister on the sole of his foot that quickly progressed into the hole seen here in this picture.

After 2 PEMF sessions beginning in early June 2011, the swelling and discoloration in his calf and ankle diminished dramatically.

After 4 more sessions, and 19 days total, the healing was much more than we expected.

PEMF and the spine

In a long-term study entitled: "Spine fusion for discogenic low back pain: outcome in patients treated with or without pulsed electromagnetic field stimulation", Marks RA. (*Richardson Orthopaedic Surgery, TX, USA*) randomly selected 61 patients who underwent lumbar fusion surgeries for discogenic low back pain between 1987 and 1994 and had failed to respond to preoperative conservative treatments. Average follow-up time was 15.6 months postoperatively.

Fusion succeeded in 97.6% of the 42 patients who received PEMF stimulation for only 52.6% of the 19 patients who did not receive electrical stimulation of any kind.

A similar study by Richard A. Silver, M.D. (*Tucson Orthopaedic & Fracture Surgery Associates, Ltd., Tucson, AZ, USA*) with 85 patients who had undergone surgery of posterior lumbar interbody fusion (PLIF) and had risk factors associated with a poor prognosis for healing, including smoking, prior back surgery, multiple spinal levels fused, diabetes millitus, and obesity, roentgenographic examination and clinical evidence indicated that all but two patients achieved successful fusion. Of the 83 patients with successful spinal fusion, 29 (34.9%) were assessed as "excellent," 45 (54.2%) as "good," 3 (3.6%) as "fair", and 6 (7.2%) as "poor".

Adjunctive treatment with PEMF appeared effective in promoting spinal fusion following PLIF procedures across all patient subgroups.

PEMF, cartilage and bones

In a study entitled: "Modification of biological behavior of cells by Pulsing Electro-magnetic fields", 20 subjects of ages between 57 and 75 years with decreased bone mineral density as defined by a bone densitometer, were treated with PEMF therapy during a period of 12 weeks by Ben Philipson, Curatronic Ltd. (*University of Hawaii School of Medicine, HI, USA*). After a period of 6 weeks, the bone density rose in those patients with an average of 5.6%.

Properly applied pulsed electromagnetic fields, if scaled for whole body use, have clear clinical benefits in the treatment of bone diseases and related pain, often caused by micro-fractures in vertebrae. In addition, joint pain caused by worn out cartilage layers can be treated successfully, through electromagnetic stimulation.

PEMF application promotes bone union by electric current induction, which changes the permeability of cell membrane allowing more ions across, affects the activity of intracellular cyclic adenosine monophosphate (cAMP) and cyclic guanosine monophosphate (cGMP), and accelerates osteoblast differentiation by activation of p38 phosphorylation.

PEMF stimulation also increases the partial oxygen pressure and calcium transport. Repair and growth of cartilage is thus stimulated, preventing grinding of the bones.

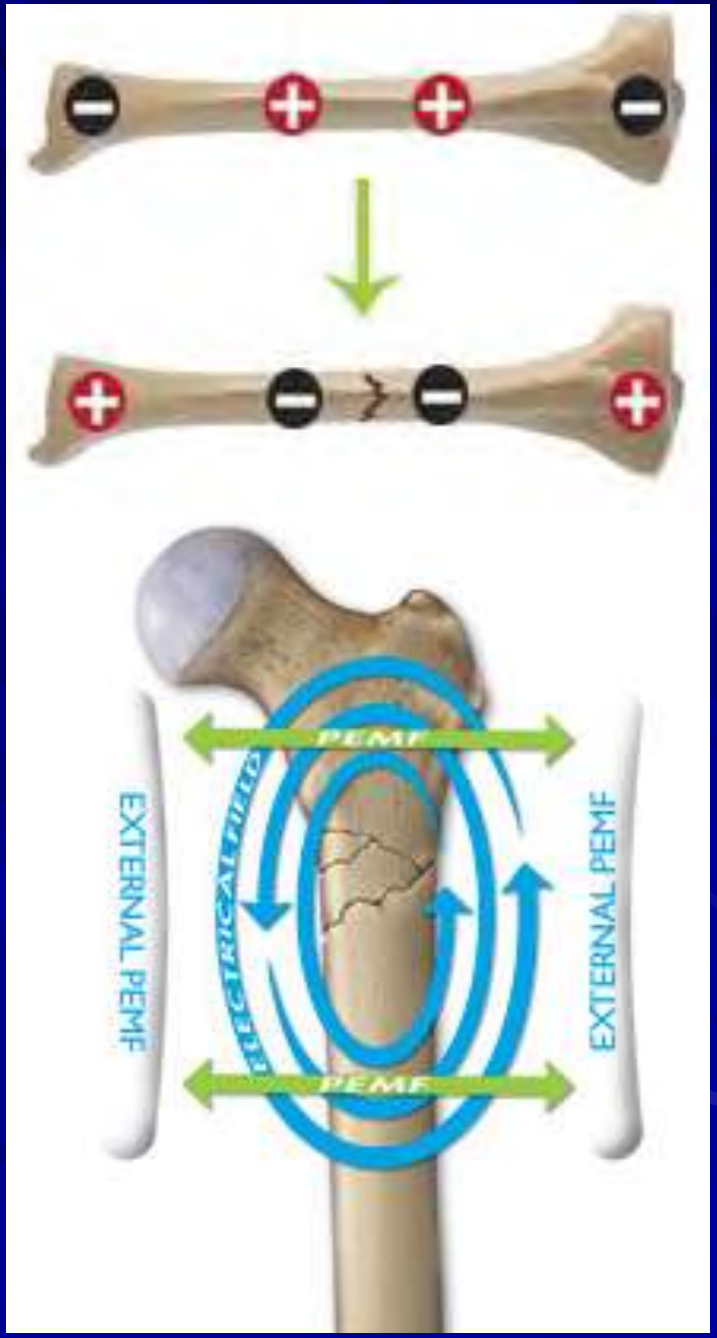
Bone Has Electrical Qualities

Bone has electrical qualities in its healthy physiological condition. Healthy bone maintains a dynamic balance between positive and negative charges.

A bone fracture changes the polarity at the fracture site to an electronegative environment. This negative polarity indicates that the body's natural repair process has begun.

When human bone is bent or broken, it generates an electrical field. This low-level electrical field activates the body's internal repair mechanism, which in turn stimulates bone healing.

In some patients, this healing process is impaired or absent. The fracture fragments may not mend properly, and a nonunion results.



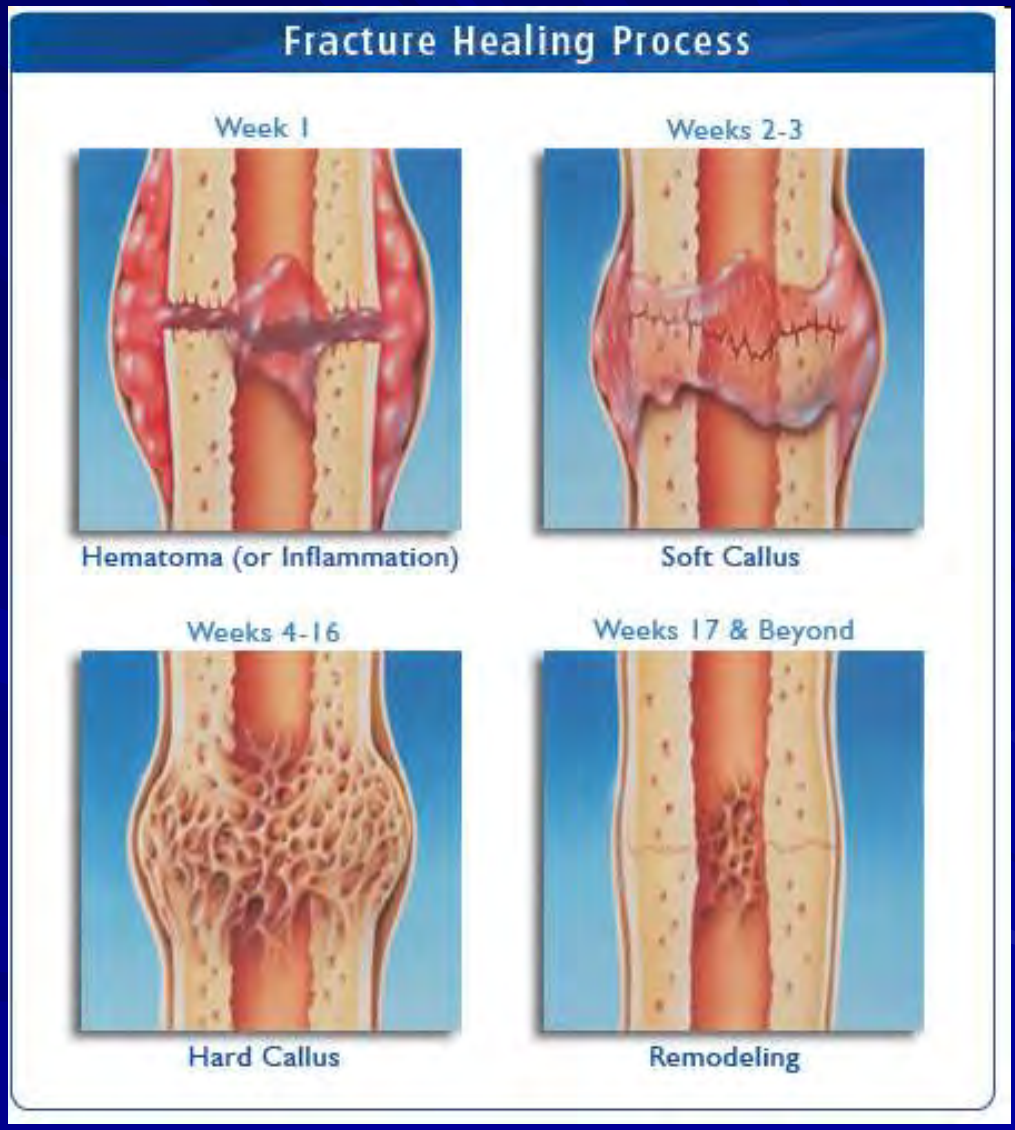
http://www.bonestimulation.com/physio/how_it_works.html

PEMF Bone Growth Stimulation

Electrical currents have been used to heal broken bones since the mid 1800s. However, it wasn't until the 1950s that scientists made an important discovery.

PEMF enhances the electrical polarity by inducing an electrical field at the fracture site which supports the natural healing process and stimulates fracture repair.

PEMF bone growth stimulation generates a time varying magnetic field within the body. The electric potential created by PEMF stimulates fracture healing.



http://www.bonestimulation.com/physio/how_it_works.html

J Biomed Eng. 1988 Jul;10(4):301-4.

Treatment of delayed- and non-union of fractures using pulsed electromagnetic fields.

Colson DJ, Browett JP, Fiddian NJ, Watson B.
Department of Medical Electronics, St Bartholomew's Hospital, London, UK.

Abstract

A prospective series of 32 consecutive patients, with 33 long-bone fractures suffering from delayed- or non-union were treated by pulsed electromagnetic fields (PEMF) or by PEMF with surgery. The management regime for the PEMF treatment was simpler and less rigid than that reported by Bassett et al. and our stimulation waveform was also different.

Nineteen fractures (100%) treated with surgery and PEMF united within nine months of the commencement of PEMF treatment. Fourteen fractures were treated with PEMF alone. Twelve (86%) united within ten months and two failed to unite.

The results of this study suggest that the stimulating waveform is less critical than is claimed by Bassett et al. and that a simpler and easier management regime for PEMF treatment can be just as effective. Alternatively PEMF may have no effect on fracture healing.

PMID:3266275[PubMed - indexed for MEDLINE]

Orthopedics. 1992 Jun;15(6):711-9.

Treatment of ununited tibial fractures: a comparison of surgery and pulsed electromagnetic fields (PEMF).

Gossling HR, Bernstein RA, Abbott J.
Department of Orthopedic Surgery, University of Connecticut Health Ctr

Abstract

The use of pulsed electromagnetic fields (PEMF) is gaining acceptance for the treatment of ununited fractures. The results of 44 articles published in the English language literature have been compiled to assess the effectiveness of PEMF vs surgical therapy.

After multiple failed surgeries, the success rate of PEMF is reported to be greater than with surgery; this discrepancy increases with additional numbers of prior surgeries. In infected nonunions, the results of surgical treatment decreased by 21% and were less than the results utilizing PEMF (69% vs 81%). In open fractures, surgical healing exceeded PEMF (89% vs 78%), whereas in closed injuries PEMF cases healed more frequently (85% vs 79%).

In general, PEMF treatment of ununited fractures has proved to be more successful than noninvasive traditional management and at least as effective as surgical therapies. Given the costs and potential dangers of surgery, PEMF should be considered an effective alternative. Experience supports its role as a successful method of treatment for ununited fractures of the tibia.

PMID:1608864[PubMed - indexed for MEDLINE]

Case Report

Management of a tibial periprosthetic fracture following revision knee arthroplasty using a pulsed electromagnetic field stimulation device: a case report

Ashtin Doorgakant, Mohammed A Bhutta and Hans Marynissen
Trauma and Orthopaedics, North Western Deanery, East Lancashire Hosp UK
Cases Journal 2009, 2:8706doi:10.4076/1757-1626-2-8706

Periprosthetic fractures associated with total knee arthroplasty are rare but present a challenging problem particularly when associated with revision arthroplasty. Fractures around tibial stems are particularly difficult with no accepted technique in their management.

This case describes a tibial periprosthetic fracture following a revision knee arthroplasty, which was successfully managed with a Pulsed Electro-Magnetic Field (PEMF) bone stimulation device. We believe this to be first reported use of a bone stimulation device in this clinical environment.

Eight months from sustaining the periprosthetic fracture and 7 months from the application of the PEMFD complete bony union was achieved clinically and radiologically (Figure 2C &2D). At 21 months from fracture and 14 month from bony union the patient is mobilising fully weight-bearing and is asymptomatic.

http://www.casesjournal.com/content/2/1/8706

Med Biol Eng Comput. 1992 May;30(3):257-66.

Treatment of chronic wounds by means of electric and electromagnetic fields.

Vodovnik L, Karba R.
Faculty of Electrical & Computer Engineering, University of Ljubljana, Slovenia.

PubMed.gov
U.S. National Library of Medicine
National Institutes of Health

Abstract

The healing of a cutaneous wound is accompanied by endogeneous electrical phenomena. Not knowing whether they represent merely a side-effect of the physiological processes which take course during healing or whether they play a much more important role as mediators of healing, externally applied electricity was examined as a therapeutic tool for the enhancement of natural regenerative processes. In the present review a historical literature survey dealing with human applications of electric current for wound healing acceleration is given. It presents a complete palette of heterogeneous studies, differing in the parameters of applied electric current, in delivery modes as well as in the types of wounds being stimulated.

Few studies have assessed the effectiveness of electrical stimulation on chronic wounds. In spite of the extensive work performed in the field of electrical wound healing we remain only part way towards explaining the mechanisms by which electricity reinforces the regenerative capabilities of injured tissue as well as only part way towards the selection of the optimal stimulation method from among the published reports. Nevertheless, the evidence suggests it is a potentially useful, accessible and cheap therapy, which might play a valuable role in everyday practice.

Ann Readapt Med Phys. 2008 Jul;51(6):441-51.

Electrical stimulation and muscle strengthening.

Dehail P, Duclos C, Barat M.
EA 4136 handicap et système nerveux, service de médecine physique et réadaptation, hôpital Pellegrin Bordeaux cedex, France. patrick.dehail@chu-bordeaux.fr

PubMed.gov
U.S. National Library of Medicine
National Institutes of Health

Abstract

Objective to identify the effects of application methods and indications of direct muscle electrostimulation on strength gain.

Literature review and analysis of articles from Medline database with the following entries: muscular or neuromuscular, electromyostimulation, electrical stimulation, strengthening, strength training, immobilization, muscle dystrophy, bed-rest, bed-bound, knee or hip surgery, postoperative phase, cachexia, sarcopenia, and their French equivalent.

Because of its specific muscle recruitment order, different from that of voluntary contraction, direct muscle electrostimulation is theoretically a complementary tool for muscle strengthening. It can be used in healthy subjects and in several affections associated with muscle function loss.

Its interest seems well-established for post-traumatic or postsurgery lower-limb immobilizations but too few controlled studies have clearly shown the overall benefits of its application in other indications. Whatever the indication, superimposed or combined electrostimulation techniques are generally more efficient than electrostimulation alone.

Karen suffers from Guillian Barre Syndrome, a debilitating autoimmune disease that causes severe nerve damage and paralysis. She was wheelchair bound for 9 years, was in constant pain, had no feeling in her hands and fingers, was unable to care for herself or her family, and was suffering from chronic depression as well.

After daily treatments using Pulsed Electro Magnetic Field (PEMF), Karen is walking again.

She **is no longer in constant pain** and has regained sensation in her hands and fingers. She can cook and care for herself and her family, and is happy to be able to read a book once again… a favorite past-time that she was unable to do before PEMF because she couldn't hold a book or feel to turn the pages.

Karen is also **free from her chronic depression,** which is also an indicated and FDA approved therapy that PEMF offers.

View Karen's story at http://www.gentlemethod.com/PEMF_Therapy.html or On You Tube at http://www.youtube.com/watch?v=InUQagZByfM&feature=player_embedded

PEMF and multiple sclerosis

At the Biologic Effects of Light 1998 Symposium, Richards *et al.* explain the effects of pulsing magnetic field on brain electrical activity in multiple sclerosis:

Recently, a histologic study has also shown that widespread axonal damage occurs in MS along with demyelination. What is the possible connection between MS and bio-electromagnetic fields? We recently published a review entitled "Bio-electromagnetic applications for multiple sclerosis," which examined several scientific studies that demonstrated the effects of electromagnetic fields on nerve regeneration, brain electrical activity (electro-encephalography), neurochemistry, and immune system components. All of these effects are important for disease pathology and clinical symptoms in MS".

MS patients were exposed to a magnetic pulsing device that was either active (PEMF) or inactive (placebo) for two months. Each MS patient received a set of tests to evaluate MS disease status before and after wearing the device.

There was a significant improvement in the performance scale combined rating for bladder control, cognitive function, fatigue level, mobility, spasticity, and vision. There was also a significant change between pre-treatment and post-treatment in alpha EEG magnitude during the language task.

Static Magnetic Field Exposure Reproduces Cellular Effects of the Parkinson's Disease Drug Candidate ZM241385

Zhiyun Wang, Pao-Lin Che, Jian Du, Barbara Ha, Kevin J. Yarema*
Department of Biomedical Engineering, The Johns Hopkins University,
Baltimore, Maryland, United States of America

Abstract

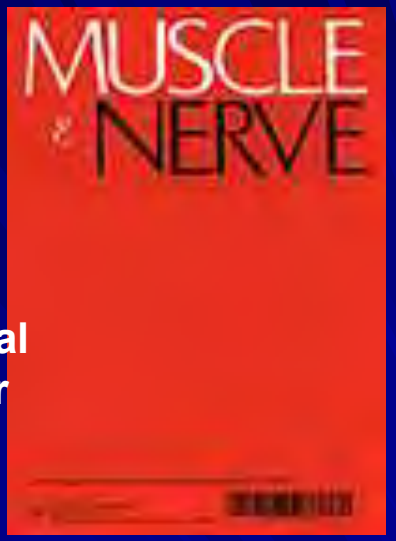
This study was inspired by coalescing evidence that magnetic therapy may be a viable treatment option for certain diseases. This premise is based on the ability of moderate strength fields (i.e., 0.1 to 1 Tesla) to alter the biophysical properties of lipid bilayers and in turn modulate cellular signaling pathways. In particular, previous results from our laboratory (Wang et al., BMC Genomics, 10, 356 (2009)) established that moderate strength static magnetic field (SMF) exposure altered cellular endpoints associated with neuronal function and differentiation. Building on this background, the current paper investigated SMF by focusing on the adenosine A2A receptor (A2AR) in the PC12 rat adrenal pheochromocytoma cell line that displays metabolic features of Parkinson's disease (PD).

Methodology and Principal Findings: SMF reproduced several responses elicited by ZM241385, a selective A2AR antagonist, in PC12 cells including altered calcium flux, increased ATP levels, reduced cAMP levels, reduced nitric oxide production, reduced p44/42 MAPK phosphorylation, inhibited proliferation, and reduced iron uptake. SMF also counteracted several PD-relevant endpoints exacerbated by A2AR agonist CGS21680 in a manner similar to ZM241385; these include reduction of increased expression of A2AR, reversal of altered calcium efflux, dampening of increased adenosine production, reduction of enhanced proliferation and associated p44/42 MAPK phosphorylation, and inhibition of neurite outgrowth.

Neuromuscular electrical stimulation in neurorehabilitation

Lynne R. Sheffler MD*, John Chae MD

Article first published online: 13 FEB 2007



Abstract

This review provides a comprehensive overview of the clinical uses of neuromuscular electrical stimulation (NMES) for functional and therapeutic applications in subjects with spinal cord injury or stroke.

Functional applications refer to the use of NMES to activate paralyzed muscles in precise sequence and magnitude to directly accomplish functional tasks. In therapeutic applications, NMES may lead to a specific effect that enhances function, but does not directly provide function.

The specific neuroprosthetic or "functional" applications reviewed in this article include upper- and lower-limb motor movement for self-care tasks and mobility, respectively, bladder function, and respiratory control.

Specific therapeutic applications include motor relearning, reduction of hemiplegic shoulder pain, muscle strengthening, prevention of muscle atrophy, prophylaxis of deep venous thrombosis, improvement of tissue oxygenation and peripheral hemodynamic functioning, and cardiopulmonary conditioning.

Perspectives on future developments and clinical applications of NMES are presented. Muscle Nerve, 2007

PEMF and the Brain

A four-week double-blind, placebo-controlled study conducted by Uni der Bundeswehr (*Munich, Germany*) assessed the efficacy of PEMF Therapy for Insomnia. One hundred one patients were randomly assigned to either active treatment (n = 50) or placebo (n = 51) and allocated to one of three diagnostic groups: sleep latency; interrupted sleep; or nightmares. The results showed 70% (n = 34) of the patients given active PEMF treatment experienced substantial or even complete relief of their complaints; 24% (n = 12) reported clear improvement; 6% (n = 3) noted a slight improvement. Only one placebo patient (2%) had very clear relief; 49% (n = 23) reported slight or clear improvement; and 49% (n = 23) saw no change in their symptoms. No adverse effects of treatment were reported.

Stunning results were obtained in a study entitled "Protection against focal cerebral ischemia following exposure to a pulsed electro-magnetic field", Grant G *et.al* (*1994 Department of Neurosurgery, Stanford University, CA, USA*) stated: *"There is evidence that electro-magnetic stimulation may accelerate the healing of tissue damage following ischemia. Exposure to pulsed electro-magnetic field attenuated cortical ischemia edema on MRI at the most anterior coronal level by 65%. On histological examination, PEMF exposure reduced ischemic neuronal damage in this same cortical area by 69% and by 43% in the striatum. Preliminary data suggest that exposure to a PEMF of short duration may have implications for the treatment of acute stroke".*

EIGHTEEN YR-OLD YOUNG MAN RECOVERING FROM AUTISM WITH PEMF THERAPY!

Christian was diagnosed with Cerebral Palsy, Autism and ADHD. He had anxiety and anger issues stemming from associated problems including limited verbal and communication skills, stuttering, inability to focus or look people in the eye. He also had physical difficulty walking and maintaining his balance.

After just a month and a half of PEMF treatments, Christian no longer stutters or loses his balance. He is calmer, more peaceful, has energy and focus and feels like he has awakened from a long sleep. His mom Christine says “he even has a girlfriend now!”

View Christian’s story here: http://www.pemf.us/autism-video/

Transcranial Magnetic Stimulation (TMS)
A Cure for Depression?

Dr. Oz investigates 'Transcranial Magnetic Stimulation', or TMS, a groundbreaking therapy for depression that's both noninvasive and FDA approved.

TMS is thought to help correct electrical signaling and chemical imbalances in the brain that trigger depression.

In transcranial magnetic stimulation (TMS), magnetic fields are sent through the scalp and skull to a particular area of the brain. When the magnetic field enters the brain it creates a small electrical current. This electrical current stimulates the brain cells (neurons) in a targeted brain area and causes them to fire (or send an electrical impulse).

http://www.doctoroz.com/videos/transcranial-magnetic-stimulation-cure-depression-pt-1

Bill Doyle: Treating cancer with electric fields

TED Ideas worth spreading

The [Tumor Treating Fields] patients can undergo all the activities of their daily life. There's none of the tiredness. There's none of what is called the ‘chemo head.’

Surgery, chemotherapy and radiation are the best-known methods for treating cancer. At TEDMED, Bill Doyle presents a new approach, called Tumor Treating Fields, which uses electric fields to interrupt cancer cell division. Still in its infancy -- and approved for only certain types of cancer -- the treatment comes with one big benefit: quality of life. With his company Novocure, Bill Doyle works to bring breakthrough medical technologies to doctors and patients.

http://www.ted.com/talks/lang/en/bill_doyle_treating_cancer_with_electric_fields.html

Biol Psychiatgy. 2010 Jul 15;68(2):163-9. Epub 2010 Apr 10.

Transcranial low voltage pulsed electromagnetic fields in patients with treatment-resistant depression.

|\/lartinv K, Lunde M, Bech P. Psychiatric Research Unit, Mental Health Center North Zealand, Hillerad, Denmark.

Abstract

BACKGROUND: Approximately 30% of patients with depression are resistant to antidepressant drugs. Repetitive transcranial magnetic stimulation has been found effective in combination with antidepressants in this patient group. The aim of this study was to evaluate the antidepressant effect of a new principle using low-intensity transcranially applied pulsed electromagnetic fields (T-PEMF) in combination with antidepressants in patients with treatment-resistant depression.

METHODS: This was a sham-controlled double-blind study comparing 5 Weeks of active or sham T-PEMF in patients with treatment-resistant major depression. The antidepressant treatment, to which patients had been resistant, was unchanged 4 weeks before and during the study period. Weekly assessments were performed using both clinician-rated and patientrated scales. The equipment was designed as a helmet containing seven separate coils located over the skull that generated an electrical field in tissue with orders of magnitude weaker than those generated by rTMS equipment.

RESULTS: Patients on active T-PEMF showed a clinically and statistically significant better outcome than patients treated with sham T-PEMF, with an onset of action Within the first Weeks of therapy. Effect size on the Hamilton 17-item Depression Rating Scale Was .62 (95% conñdence interval Treatment-emergent side effects were few and mild.

CONCLUSION: The T-PEMF treatment was superior to sham treatment in patients with treatment-resistant depression. Few side effects were observed. Mechanism of the antidepressant action, in light of the known effects of PEMF stimulation to the brain, is discussed.

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Scientific Publications & Presentations

Peer Reviewed Publications

Clinical Significance of Transcranial Magnetic Simulation (TMS) in the Treatment of Pharmacoresistant Depression: Synthesis of Recent Data - this study was published in the July 2009 issue of Psychopharmacology Bulletin.

Cost-effectiveness of Transcranial Magnetic Stimulation in the Treatment of Major Depression: A Health Economics Analysis - this study was published in the March 2009 issue of Advances in Therapy.

Daily Left Prefrontal Repetitive Transcranial Magnetic Stimulation in the Acute Treatment of Major Depression: Clinical Predictors of Outcome in a Multisite, Randomized Controlled Clinical Trial - this study was published in the August 2008 online version of Neuropsychopharmacology.

Transcranial Magnetic Stimulation in the Acute Treatment of Major Depressive Disorder: Clinical Response in an Open-Label Extension Trial - this study was published in the March 2008 issue of The Journal of Clinical Psychiatry.

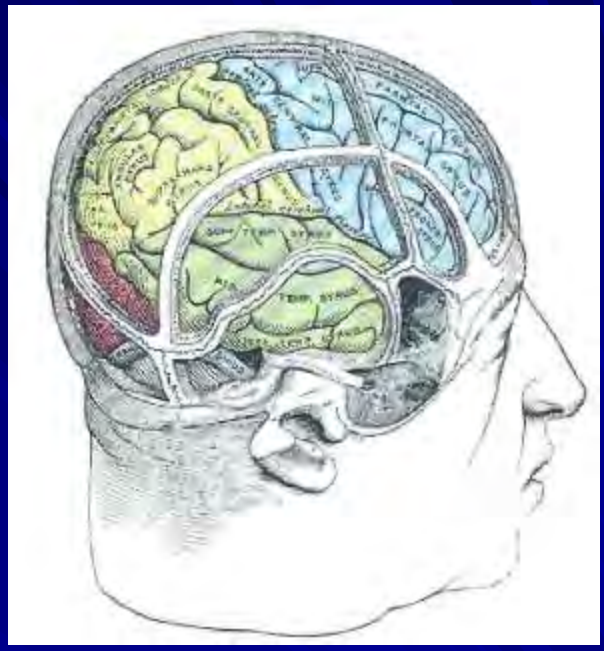
Transcranial Magnetic Stimulation in the Treatment of Major Depressive Disorder: A Comprehensive Summary of Safety Experience From Acute Exposure, Extended Exposure, and During Reintroduction Treatment - this article was published in the February 2008 issue of The Journal of Clinical Psychiatry.

Efficacy and Safety of Transcranial Magnetic Stimulation in the Acute Treatment of Major Depression: A Multisite Randomized Controlled Trial - this study was published in the December 2007 issue of Biological Psychiatry.

http://www.neurostartms.com/Physician/Clinical-Scientific-Publications-Presentations.aspx

Experimental Magnetic Pulses May Help Heal A Brain After Stroke

by Jon Hamilton – December 15, 2011



A little brain stimulation seems to speed up recovery from a stroke.

This isn‘t the sort of brain stimulation you get from conversation. It's done using an electromagnetic coil placed against the scalp.

Researchers think the treatment encourages brain cells to form new connections, allowing the brain to rewire itself to compensate for damage caused by a stroke.

The latest evidence that stimulation works comes from Italy, where researchers treated patients with a condition called hernispatial neglect.

Scientists suspect the problem occurs when a stroke causes damage that upsets the normal balance between the two sides ofthe brain. A stroke in the right side of the brain, for example, often seems to cause the healthy left side ofthe brain to become overactive and overload circuits involved in perception.

Researcher found that electromagnetic brain stimulation helped stroke patients recover motor skills, muscle strength and the ability to swallow.

Attenuation of interleukin1beta by pulsed electromagnetic fields after traumatic brain injury

Rasuuli J, Lekhrai R, White NM, Flamm ES, Pilla AA, Strauch B, Íaswer D.

Department of Neurosurgery, The Albert Einstein College of Medicine and Montefiore Medical Center, 111 E. 210th St., Bronx, NY 10467,
United States.

Abstract

Traumatic Brain Injury (TBI) is a major cause of morbidity and mortality in civilian and military populations. Inter1eukin1beta is a proinflammatory cytokine with a key role in the inflammatory response following TBI and studies indicate that attenuation of this cytokine improves behavioral outcomes. Pulsed electromagnetic fields (PEMF) can reduce inflammation after soft tissue injuries in animals and humans.

Therefore, we explored Whether PEMF signals could alter the course of production in rats subjected to closedhead contusive Weightdrop injuries (Marmarou method) and penetrating needle-stick brain injuries. Protein levels, measured by the Biorad assay, were not altered by injuries or PEMF treatment.

In addition, we verified that levels in cerebrospinal fluid (CSF) were proportional to injury severity in the contusion model. Results demonstrate that PEMF treatment attenuated levels up to 10~fold in CSF Within 6h after contusive injury and also significantly suppressed Within after penetrating injury. In contrast, no differences in IL-1 ß were seen between PEMF-treated and control groups in brain homogenates. To the authors' knowledge, this is the first report of the use of PEMF to modulate an inflammatory cytokine after TBI. These results warrant further studies to assess the effects of PEMF on other inflammatory markers and functional outcomes.

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Alzheimer's disease: improvement of visual memory and visuoconstructive performance by treatment with picotesla range magnetic fields.

Sandyk R.
NeuroCommunication Research Laboratories, Danbury, CT 06811.

Abstract
Impairments in visual memory and visuoconstructive functions commonly occur in patients with Alzheimer's disease (AD). Recently, I reported that external application of electromagnetic fields (EMF) of extremely low intensity (in the picotesla range) and of low frequency (in the range of 5Hz-8Hz) improved visual memory and visuoperceptive functions in patients with Parkinson's disease. Since a subgroup of Parkinsonian patients, specifically those with dementia, have coexisting pathological and clinical features of AD, I investigated in two AD patients the effects of these extremely weak EMF on visual memory and visuoconstructive performance.

Treatment with EMF resulted in a dramatic improvement in visual memory and enhancement of visuoconstructive performance which was associated clinically with improvement in other cognitive functions such as short term memory, calculations, spatial orientation, judgement and reasoning as well as level of energy, social interactions, and mood. The report demonstrates, for the first time, that specific cognitive symptoms of AD are improved by treatment with EMF of a specific intensity
and frequency.

http://www.pemf.us/docs/ScienStudies_Magnetic64.pdf

PEMF and Stem Cells - Research

PubMed.gov
U.S. National Library of Medicine
National Institutes of Health

Stimulation of osteogenic differentiation in human osteoprogenitor cells by pulsed electromagnetic fields: an in vitro study.
Jansen JH, van der Jagt OP, Punt BJ, Verhaar JA, van Leeuwen JP, Weinans H, Jahr H.
BMC Musculoskelet Disord. 2010 Aug 23;11:188.PMID: 20731873 [PubMed - in process]

Modulation of osteogenesis in human mesenchymal stem cells by specific pulsed electromagnetic field stimulation.
Tsai MT, Li WJ, Tuan RS, Chang WH.
J Orthop Res. 2009 Sep;27(9):1169-74.PMID: 19274753 [PubMed - indexed for MEDLINE]

Effect of pulsed electromagnetic field on the proliferation and differentiation potential of human bone marrow mesenchymal stem cells.
Sun LY, Hsieh DK, Yu TC, Chiu HT, Lu SF, Luo GH, Kuo TK, Lee OK, Chiou TW.
Bioelectromagnetics. 2009 May;30(4):251-60.PMID: 19204973 [PubMed - indexed for MEDLINE]

Osteoprotegerin (OPG) production by cells in the osteoblast lineage is regulated by pulsed electromagnetic fields in cultures grown on calcium phosphate substrates.
Schwartz Z, Fisher M, Lohmann CH, Simon BJ, Boyan BD.
Ann Biomed Eng. 2009 Mar;37(3):437-44. Epub 2009 Jan 13.PMID: 19139991 [PubMed - indexed for MEDLINE]

Pulsed electromagnetic fields enhance BMP-2 dependent osteoblastic differentiation of human mesenchymal stem cells.
Schwartz Z, Simon BJ, Duran MA, Barabino G, Chaudhri R, Boyan BD.
J Orthop Res. 2008 Sep;26(9):1250-5.PMID: 18404656 [PubMed - indexed for MEDLINE]

http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=DetailsSearch&term=PEMF+stem+cells&log$=activity

Recharge Your Life with PEMF!

Advanced cellular exercise providing electro-nutrient therapy

Electromagnetic Therapy
for energy production and cellular detoxification

In an article published in *Plos One*, November 2010, volume 5, issue 11 (Wang), page 4, Johns Hopkins' researchers found a 38% increase in ATP production in P12 cells that were placed in a static magnetic field device that we supplied.

This increase could be much higher *in vivo* with the brain's pulsed DC electromagnetic field interacting with an enhanced earth-type field resulting in increased resonance of the mitochondria. All of this leading to enhance electron transfer in the creb cycle resulting in more ATP production.

↑ ATP equals ↑ Na+ K+ pump function which leads to ↑ charge of the cell wall and ↑ metal excretion.

M.I.C.E. = Magnetically Induced Cellular *EXERCISE*

FIGHT-EM with MICE is an acronym that stands for:

F = Food and Focus - related aspect and leaky gut, and Focus (positive mental outlook): Acidophilus, Avoid food sensitivities (wheat, dairy) food supplements to include Vitamin C and D_2

I = Infections - causing cancer, cardiovascular disease, autoimmune diseases: Ozone/UVB, HBO, Silver, Vitamins A, C and D including IV Vit C

G = Genetics - and epigenetics and methylation issues needed for detoxing B-12, MSM, TMG, 5'MTHF

H = Heavy Metals and Hormones - Daily detoxification of mercury, lead; Hormonal balance and support for both men and women: Oral Chelation, Zeolite, DHEA, HRT, Melatonin, GH Support, Thyroid

T = Toxins - BPA, phtalates, and other toxins including household chemicals and everyday products: Exercise, IR/FIR Sauna, PEMF, Magnetics, Electrotherapy, cold (soft) lasers.

E = Energy and Exercise - PEMF or pulsed electromagnetic frequency therapy that promotes healing through

Magnetically Induced Cellular Exercise, or MICE

Pulse 4 Life

In 25 years of practice, I have never seen anything like the PMT-100. This device has completely changed my practice and my life. It has more than doubled my practice, and reinstilled excitement in both my practice and myself.

I could not imagine treating patients without this device in my office as I would be cheating my patients otherwise.

Every chiropractor NEEDS to have this technology in their office!

Dr. Kim Shunkwiler, DC
Westland, MI

VIDEO

"As a licensed Practitioner, you need to search for alternative ways to treat conditions. I've been practicing for 40 years and one of the most exciting things I've seen is this PEMF Technology.

Utilizing this technology adds a whole NEW dimension to a practice.

Dr. Allen Unruh, DC

VIDEO

"This is the most simplest device that can change your life and that of your patients. Every practitioner needs this type of Cellular Exercise in their Practice."

Dr. Garry Gordon
MD, DO, NP
Founder of Gordon Research Institute

I was personally involved in a bad motorcycle accident 4 years ago that left me crippled up and disabled. The Ortho team was able to save my right leg. In just 2 treatment sessions with the PMT 100 device I was able to alleviate almost 100% of the pain. This device has helped me get back a productive life.

Can you imagine a device that can provide your practice with a GREAT source of secondary stream Income and offer noticeable pain reduction for your patients? I believe that any practice without this technology will be left behind.

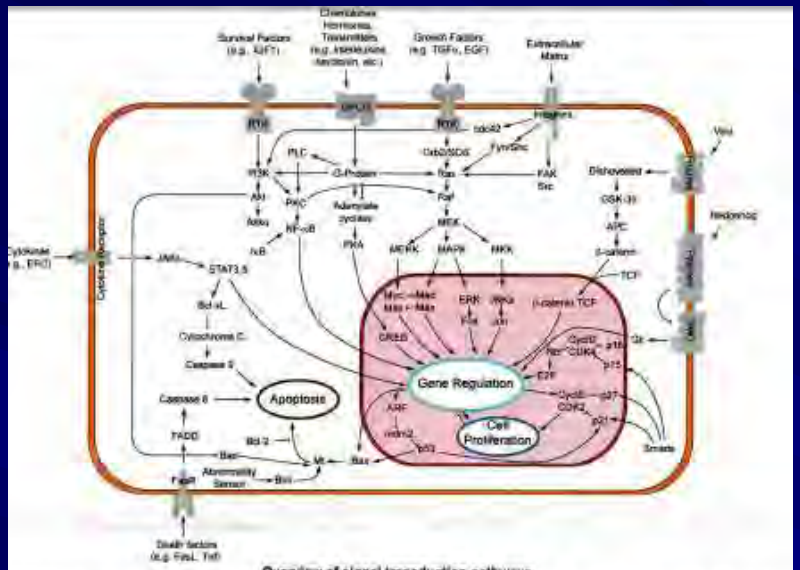
Dr. Curtis Ficenec, DC
Fargo, ND

Register Now!

http://www.pulse4life.com/

Pulsed Electro-magnetic Frequency (PEMF) Therapy

"How It Works"



Overview of signal transduction pathways

In the chronic pain state, pain signal generation can actually occur in the central nervous system without peripheral noxious stimulation. In pain management, modulation of the pain signal transmission is a far better choice than neural destruction, and that can be achieved with PEMF.

Scientific evidence shows that acute persistent pain eventually sensitizes wide dynamic neurons in the dorsal horn of the spinal cord, the wind-up phenomenon, constituting the basis of developing chronic pain syndromes *(Kristensen, 1992)*. Persistent and excessive pain has no biological good or necessary function. It is actually harmful to our well-being. Therefore, pain needs to be treated as early and as completely as possible and not to be left alone *(Adams, et al 1997)*.

The primary symptom in most patients with disorders affecting the soft tissue is pain. In many patients, daily activities are limited as pain causes a restriction of the range of movements. Causes of soft tissue pain can be depicted as musculo-skeletal, neurologic, vascular, and referred visceral-somatic or articular *(Cailliet, 1991)*. Early reports of applying electrical current to treat pain date back to before 1600 *(Ersek, 1981)*.

PEMF therapy has successfully been used for the control of pain associated with rotator cuff tendonitis, multiple sclerosis, carpal tunnel syndrome, and peri-arthritis *(Battisti et al, 1998; Lecaire et al, 1991)*. An improvement was observed in 93% of patients suffering from carpal tunnel pain and in 83% in cases of rotator cuff tendonitis. PEMF therapy was also used for treatment of migraine, chronic pelvic pain, neck pain, and whiplash injuries *(Rosch et al, 2004)*.

PEMF Therapy Reduces Pain

Many studies have demonstrated the positive effects of PEMF therapy on patients with pain, even as opposed to receiving traditional treatment as well as against a placebo group getting no treatment. Some studies focused on the rapid, short-term relief while others demonstrate the long-term effects. The effectiveness of PEMF therapy has been demonstrated in a wide variety of painful conditions.

In a study entitled: "Double-blind, placebo-controlled study on the treatment of migraine with PEMF", Sherman R. et al. *(Orthopedic Surgery Service, Madigan Army Medical Center, Tacoma, WA, USA)* evaluated 42 subjects who met the International Headache Society's criteria. During the first month of follow-up with exposure to PEMF, 73% of those receiving actual exposure, reported decreased headaches with 45% a substantial decrease and 14% an excellent decrease. Ten of the 22 subjects who had received actual exposure received 2 additional weeks of actual exposure, after their initial month. All showed decreased headache activity with 50% a substantial decrease and 38% an excellent decrease. Sherman R. et al concluded that

Visit Gordon Research Institute online to read more about the applications and benefits of PEMF such as:

- Reduced pain
- Reduced inflammation
- Increased range of motion
- Faster functional recovery
- Reduced muscle loss after surgery
- Increased tensile strength in ligaments
- Faster healing of skin wounds
- Enhanced capillary formation
- Accelerated nerve regeneration
- Reduced tissue necrosis

The scientific white paper with full study references and illustrations is entitled "How PEMF Works" and can be found under the health topic PEMF.

http://gordonresearch.com/articles_PEMF/docs/PEMFhowitworks.pdf

Health Consultations

Get a personalized health consultation! Dr. Garry Gordon offers his 53+ years of advanced medical experience to you via telephone, or in- person, for $300 per hour.

Arrangements may be made with Katie Isham, by calling her at the Gordon Research Institute at 928-472-4263, ext. 134, Fax to 928-474-3819, or by emailing Katie at kisham@longevityplus.com, to learn more.

Appointments may include a review of all prior medical records and/or any new tests that can be ordered in preparation for your personalized consultation. Test panels can be more focused on ANTI-AGING, or cancer, depending on your concerns.

Since Dr. Gordon does not accept insurance, he has made arrangements for cash paying patients to obtain substantial discounts of 70% or more for any blood tests that he orders. In Addition, Dr. Gordon now offers the most advanced and comprehensive 72 gene test panel available anywhere for $425.

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F.I.G.H.T.
for Optimal Health and Anti-Aging

These are my thoughts on how to more effectively help EVERY patient better by using Dr. Gordon's F.I.G.H.T. for health program.

Briefly, F.I.G.H.T. is an acronym that stands for:
F =Food (sensitivity and leaky gut) and Focus (mental/emotional outlook)
I = Infections
G=Genetics (and epigenetics and methylation issues needed for detoxing)
H=Heavy Metals and Hormones
T=Toxins

Using F.I.G.H.T. as a protocol for health, you will be addressing all the areas that are critical to achieve optimal health. Visit fight4yourhealth.com or gordonresearch.com.

F.A.C.T.
Forum on Anti-Aging and Complimentary Therapies

Do you ever wish you could verify your treatment plans with other alternative specialists? Join Dr. Gordon's FACT Forum of over 3000 health professional members who have 24/7 access to thousands of research articles, clinically proven protocols and treatment suggestions from their colleagues around the world.

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- »Moderated discussions with NO spam, advertising, or sale of email addresses;
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THANK YOU

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