

## **Pulsed electromagnetic fields (PEMFs) for cell injury and repair: how PEMFs promote longevity and reduce the rate of aging**

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At the cellular level aging is a process of declining capacity for and effectiveness of repair of cell injury. With aging there is cumulative, unrepaired or poorly repaired natural or unnatural cell injury. This is “death by a 1000 cuts.” Cell injury results when

- cells can no longer adapt to stress,
- have unrecoverable exposure to damaging agents or
- suffer from intrinsic abnormalities, whether genetic or nutrient-based.

Cell injury can progress from milder reversible states through more severe irreversible conditions leading to tissue and or organ failure of varying degrees, and finally senescent apoptotic or necrotic cell death.

Promoting longevity requires intervention of the underlying causal conditions of cell injury where possible and facilitating cell recovery and repair at the earliest stages of cell injury.

In the stages of reversible injury there is

- reduced oxidative phosphorylation with depletion of ATP,
- cellular edema caused by changes in ion and water flows,
- mitochondrial and cytoskeleton alterations and
- DNA damage.

Aging can be slowed or reversed by ongoing health maintenance, including mitigating known causal circumstances, and also proactive use of low intensity, low frequency, (LI/ELF) PEMFs.

LI/ELF PEMFs improve the rate of aging by reducing and/or reversing various degrees of cell injury.

LI/ELF PEMFs are known to pass uninhibited through the body, while inducing charge in cells and tissues, consequently affecting biochemical and physiologic processes in the direction of reducing cell injury, and therefore aging.

PEMFs improve various physiologic processes including

- production of nitric oxide,
- reducing pain and inflammation,
- improving circulation,
- enhancing cellular membrane function and metabolism, communication and replication and growth and repair.

PEMFs improve biochemical activity at the cellular level and allow nutrients and other life extending chemistry in the body to migrate more freely to be more functionally useful.

LI/ELF PEMFs should be part of a comprehensive program to reduce suffering and enhance higher quality longevity.

Pulsed electromagnetic fields (PEMFs) for cell injury and repair:  
how PEMFs promote longevity and reduce the rate of aging

With about 70 trillion cells in an adult body, cell injury is common and repair is ongoing. Wherever there is pain, suffering and dysfunction there is cell injury.

Cell injury results when cells are

- stressed so that they are no longer able to adapt or
- when cells are exposed to damaging agents or
- suffer from intrinsic abnormalities.

The normal cell has a fairly narrow range of function and structure.

It handles physiologic demands, maintaining a steady state called *homeostasis*.

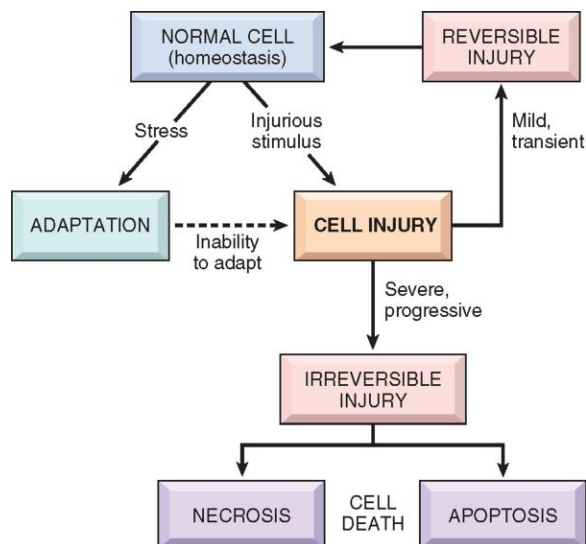
*Adaptations* are reversible functional and structural responses to more severe physiologic stresses and some pathologic stimuli,

*With adaptation* new but potential, nonetheless altered steady states still happen, allowing the cell to survive and continue to function. Call this balanced imbalance.

*CELL INJURY* results when

- the limits of adaptive responses of cells are exceeded or
- if cells are exposed to injurious agents or stress,
- are deprived of essential nutrients, or
- become compromised by mutations that affect essential cellular constituents.

For instance, in response to increased hemodynamic loads, the heart muscle becomes enlarged, a form of adaptation, and can even undergo injury. If the blood supply to the myocardium is compromised or inadequate, the muscle first suffers reversible injury, manifested by certain cell changes. If this is not reversed, the cells suffer irreversible injury and die.



**FIGURE 1-1** Stages of the cellular response to stress and injurious stimuli.

*From Kumar: Robbins and Cotran Pathologic Basis of Disease, Professional Edition , 8th ed.*

All disease starts with micro-molecular or structural alterations in individual cells.

Injury to sufficient numbers of cells and to the matrix between cells ultimately leads to *tissue and organ injury*. The cumulative burden of these unrecovered cells and cell functions, leads to aging.

The end results of genetic, biochemical, or structural changes in cells and tissues are functional abnormalities, which lead to clinical manifestations (symptoms and signs) and then may become disease.

Cell Injury progresses through a reversible stage and may end in cell death.

The hallmarks of reversible injury are

- reduced oxidative phosphorylation with depletion of ATP,
- cellular swelling caused by changes in ion concentrations and water influx
- mitochondria and cell skeleton alterations
- and DNA damage.

Within limits, the cell can repair these derangements and, if the injurious stimulus goes away, can return to normal.

With continuing damage, the injury

- becomes irreversible,
- the cell cannot recover and
- it dies, either through necrosis or apoptosis.

The major causes of cell injury are:

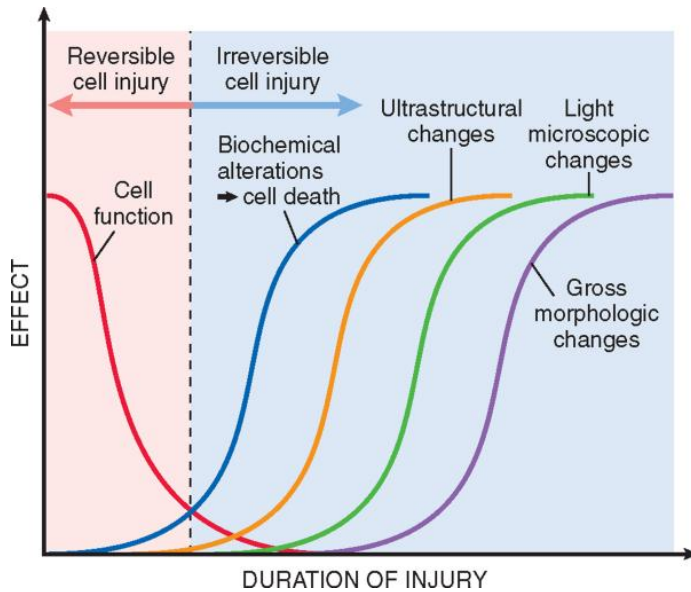
- Oxygen Deprivation
- Physical Agents
- Chemical Agents and Drugs
- Infectious Agents
- Immunologic Reactions
- Genetic Derangements
- Nutritional Imbalances

Physical agents causing cell injury include

- mechanical trauma,
- extremes of temperature (burns and deep cold),
- sudden changes in atmospheric pressure,
- radiation, and electric shock.

Mechanical trauma, which we most commonly associate with injury, including sprains, dislocations, muscle tears, fractures, etc., are a fraction of the causes of aging.

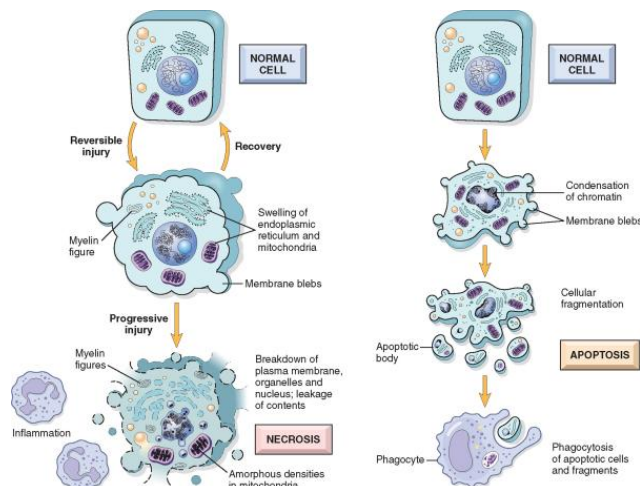
Cell injury progresses through various stages, during any of which repair may be possible if adequately facilitated, either naturally or by the application of various treatments.



**FIGURE 1-7** Sequential development of biochemical and morphologic changes in cell injury. Cells may become rapidly nonfunctional after the onset of injury, although they are still viable, with potentially reversible damage; a longer duration of injury may eventually lead to irreversible injury and cell death. Note that irreversible biochemical alterations may cause cell death, and typically this precedes ultrastructural, light microscopic, and grossly visible morphologic changes.

*From Kumar: Robbins and Cotran Pathologic Basis of Disease, Professional Edition, 8th ed.*

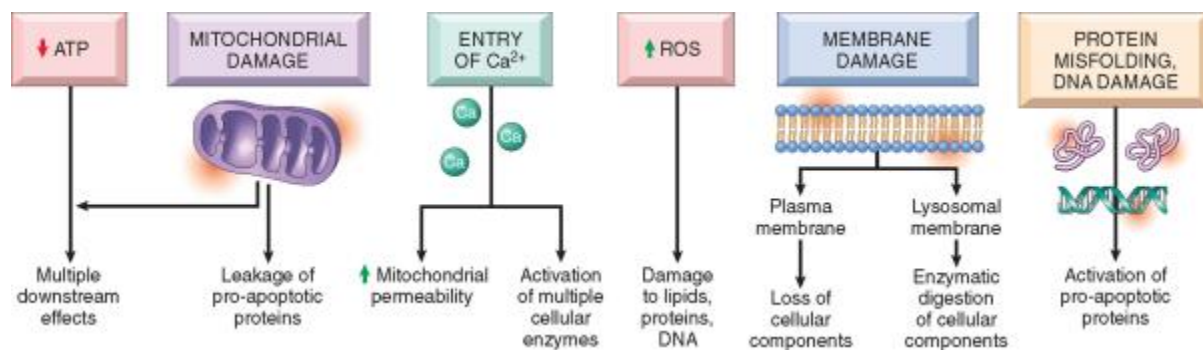
All stresses and noxious influences exert their effects first at the molecular or biochemical level. There is a time lag between the stress and the physical changes of cell injury or death.



Persistent or excessive injury, causes cells to pass a nebulous “point of no return” into irreversible injury and *cell death*.

Let me say it again, cellular or tissue swelling is the first manifestation of almost all forms of injury to cells.

The cell response to injurious stimuli depends on the nature of the injury, its duration, and its severity.



**FIGURE 1-16** The principal mechanisms of cell injury, and their biochemical and functional effects, are shown.

*From Kumar: Robbins and Cotran Pathologic Basis of Disease, Professional Edition, 8th ed.*

The consequences of cell injury depend on the type, state, and adaptability of the injured cell, including nutritional and hormonal status, vulnerability of the cell, eg, to hypoxia, degree of toxic exposure.

Any injurious stimulus simultaneously triggers multiple interconnected mechanisms that damage cells.

Treatment and prevention approaches should address multiple mechanisms of cell injury.

Poor natural apoptosis (“too little or too much”) can also explain aspects of a wide range of diseases.

Increased apoptosis results in excessive premature cell death causing neurodegenerative diseases, ischemic injury, eg, heart attack or stroke; and the premature death of virus-infected cells.

So-called natural aging is contributed to by progressive reductions in many hormones, loss of muscle mass, reductions in GI tract neurons, stomach acid production, clouding of lenses, etc. With age there are physiologic and structural alterations in almost all organ systems.

Cellular aging is therefore the progressive accumulation over the years of chronic sublethal cell injury that may or may not lead to cell death but does lead to a diminished capacity of the cell to respond to injury.

PEMFs can be used to improve body function and reduce the effects of cell injury.

Low-frequency pulsed electromagnetic fields or PEMF's, at the right intensities penetrate through the entire body affecting every cell in their path. Either whole body or smaller more intense PMFs affect all the cells in the body.

The book *Magnetic therapy in Eastern Europe* reviews the use of PEMFs for various medical applications and some of the known mechanisms of how PEMF's work in biology.



The classic effects of PMFs touch almost all aspects of cell injury, especially early in the injury process.

They work to:

- reduce edema,
- improve circulation,
- open cell membrane channels,
- increase production of ATP,
- stimulate repair mechanisms, and
- enhance apoptosis of chronic inflammatory cells.

Only cells that are out of balance, are affected by PEMF energy.

There is no other technology that I'm aware of that can with a single modality have both the range and depth of action that clinically directed PMFs can have, with no harm to healthy cells.

The effects of pulsating magnetic fields on the cell are illustrated below:

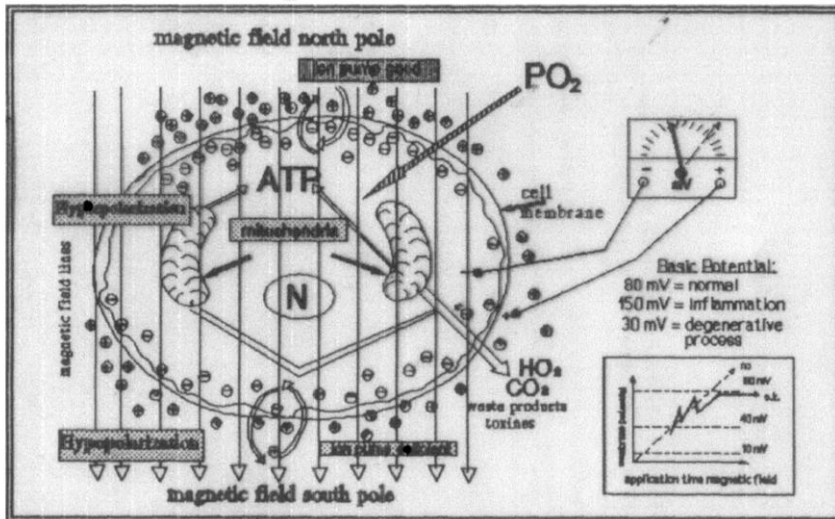


Figure 1 - Effects of pulsating magnetic fields on the cell

Low intensity PMFs have long been approved by the US FDA for healing nonunion fractures.

There is the question of field intensity. The PEMF 100 and Curatron provide a wide range of field intensities, up to the level to produce muscle contraction in

the case of the PEMF 100.

There are now at least two FDA approved commercially available PEMF systems with field intensities comparable to the PEMF 100. One application is specifically used for muscle contraction and the other is transcranial magnetic stimulation.

With high level intensity stimulation, I have been able to see improvements, particularly with musculoskeletal and neurologic conditions, more rapidly than with any other therapeutic approach, and without simply masking the underlying condition.

Most people with any injury or disability usually benefit by being able to rehab and get back to work much faster.

Because PEMF's penetrate through all biologic tissues, equally well, unlike laser, electrical stimulation and ultrasound, they may be simply used to go through clothing, shoes, casts, wraps, bandages and splints, decreasing prep time.

## **Conclusion**

Everybody has at least millions of cells in the process of cell injury on a constant, daily basis. Unresolved cell injury, leads to cell death and contributes to and accelerates human aging. Pulsed electromagnetic fields (PEMFs) operate at the individual cell level, in every organ of the body, to help reverse cell injury, especially when used early in the injury process. To prevent and reverse cell injury at the earliest stages, requires daily use of PEMF's throughout adult life. Waiting for cell injury to get to the point of obvious disease or negative health conditions, allows aging to progress unnoticed, not to mention having all the consequences of disease. Unfortunately, most humans do wait until they have a significant health condition before they begin using PEMF's. There are many PEMF systems available for relatively low cost, that allow whole body stimulation to reduce the injury of cells and consequently aging. One of the reasons DrPawluk.com was created was to provide ready access to PEMF devices and education to consumers regarding the value of these devices for supporting the treatment of many health conditions and as a tool for anti-aging and prolonging healthier quality of life.