Hofmeir Magnetics Ltd
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The science behind pulsed magnetic fields and its impact on ATP

All mammals are made up of trillions of cells, and there are hundreds of different cell types. Each cell type has a precisely assigned function, for example, a muscle fibre cell will only function as a muscle fibre cell and a brain cell will only function as a brain cell.

The productivity of each cell and the rate at which it can perform its specific function will depend on how much energy is held within that cell. A structure within all mammalian cells, called the mitochondria, is responsible for producing cellular energy in the form of adenosine triphosphate, or ATP.

ATP has an important impact on the cell membrane, having influence over the flow of calcium and potassium ions in and out of the cell via ion channels. Energy generated by ATP is used for opening and closing the ion channels within the cell membrane.

This flow of ions, in particular calcium ions, determines whether or not the cell functions and crucially, if it can function again after activity and subsequent rest. In the case of a muscle cell for example, the flow of calcium ions, influenced by ATP, will determine whether the large muscles of a horse can move and to what extent, and then move again after sufficient rest.

Any type of movement requires energy in the muscle cells. In fact, the undisturbed supply of energy plays a prominent role in movement, especially with regard to the quality of the movement, coordination, endurance and strength development.

However, ATP generated energy isn’t in constant supply. When ATP runs out, exhaustion will set in until the cells have had time to rest and regenerate further ATP.

When it comes to the continuous and excessive energy demands of intensive training or competing, the efficiency of this process is key. Not only that, the quality of the *recovery* after exertion is important to energy production. Optimal rest mode of the cell membrane is essential - only then can optimal cell function be achieved again.

Disturbances in the surrounding environment such as inflammation caused by overexertion, stress or injury, also has a measurable effect on mitochondrial energy provision, reducing ATP generated energy and resulting in the cell losing its functional quality.

Hofmag PEMF technology has been proven to significantly increase mitochondrial ATP energy production and stimulate calcium ion signalling to support cellular function. What's more, this positive effect is more pronounced on the recovery of so-called dysfunctional (stressed, exhausted, injured) cells than normal, functional cells.

The effect of Hofmag PEMF treatment on dysfunctional cells as part of the active recovery process is therefore significantly beneficial to cell functioning, recovery and performance.

For further reading on the impact of high-intensity PEMF and the Hofmag on mitochondrial ATP production on the body, please refer to:

PMC PubMed Central

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10379303/

Review Pulsed Electromagnetic Fields (PEMF)—Physiological Response and Its Potential in Trauma Treatment Jonas Flatscher 1,†, Elizabeth Pavez Loriè 1,† , Rainer Mittermayr 2,* , Paul Meznik 2 , Paul Slezak 1 , Heinz Redl 1 and Cyrill Slezak 1,3,*

Abstract: Environmental biophysical interactions are recognized to play an essential part in the human biological processes associated with trauma recovery. Many studies over several decades have furthered our understanding of the effects that Pulsed Electromagnetic Fields (PEMF) have on the human body, as well as on cellular and biophysical systems. These investigations have been driven by the observed positive clinical effects of this non-invasive treatment on patients, mainly in orthopedics. Unfortunately, the diversity of the various study setups, with regard to physical parameters, molecular and cellular response, and clinical outcomes, has made it difficult to interpret and evaluate commonalities, which could, in turn, lead to finding an underlying mechanistic understanding of this treatment modality. In this review, we give a birds-eye view of the vast landscape of studies that have been published on PEMF, presenting the reader with a scaffolded summary of relevant literature starting from categorical literature reviews down to individual studies for future research studies and clinical use. We also highlight discrepancies within the many diverse study setups to find common reporting parameters that can lead to a better universal understanding of PEMF effects. Keywords: biophysical forces; clinical use; regeneration; cellular signaling; electromagnetic field; PEMF

Ludwig Boltzmann Report: Adipose-derived stromal/stem cells (ASC)Tert cell line after PEMF treatment

Full report available here

1 Introduction & Summary

Pulsed electromagnetic fields (PEMF) is a non-invasive, penetrable, and patient-friendly treatment that has been in use in the clinic for many years. Therefore, it has the potential to be a promising adjuvant treatment to regulate the response and treatment locally and dynamically in tissues and organs. In recent years, PEMF has been reported to effectively support fracture healing and bone regeneration, by having positive effects on cellular mechanisms on osteoblasts, mesenchymal stem/stromal, chondrocytes, and intervertebral disc cell and their microenvironments. However, there is a discrepancy between existing data at the cellular and molecular level.

As part of the intention to know more about PEMF driven effects in cells and tissues, this study tries to observe effects after one exposure or after two sequential exposures in an adipose stem cells (ASC) cell line. The observations were focused on cell viability and cell count/proliferation. Two PEMF devices were used with only the highest dose which is provided in the respective devices and only one exposure time, giving a more comprehensive observation. The results show that the devices did not elicit any significant stress or cell damage response on the cells neither after single or sequential exposure. With regards to cells count we could conclude that the tested cell line had a reduced proliferative response which was seen only with sequential exposure and only with one device. Meaning that the device's physical properties as well as the type of exposure (single or sequential) is of importance for this cell type.

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Ludwig Boltzmann Report:

Effect of PEMF on vital cellular functions and intracellular signalling pathways in intact muscle cells

Full report available here

5 Discussion

In summary, there are only small changes in cells upon baseline conditions after PEMF treatment with both devices, although Hofmag has a tendency to show better positive effects. However, the changes are so small that it is only safe to say that PEMF treatments do not cause any harm. The trends shown by both devices (particularly by Hofmag) to speed up ATP synthesis linked respiration and to reduce intracellular RONS suggested that they can be more efficient in recovery of dysfunctional cells rather than improving normal cellular function. With that in mind, we inhibited liver mitochondria with nitric oxide, an inflammatory mediator, and then treated it with PEMF. In this single experiment both devices are showing a remarkable positive effect, which was stronger upon treatment with Hofmag. We used only one dose of treatment with Zimmer and it seems that this treatment can be optimised using our models. The effect of PEMF on damaged cells seems to be a promising way to prove the positive effect of PEMF treatment, decipher mechanisms underlying PEMF action and optimise the treatment protocol. The latter however requires further efforts.

Full report available here

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For a full list of the impact of PEMF on various health conditions, please read Jan’s report