PEMF and Your Mitochondria: The Body's Tiny Powerhouses

Can Pulsed Electromagnetic Field Therapy (PEMF) help support healthy ageing by keeping our cells' energy factories running smoothly? Mitochondria are tiny structures found inside almost all our cells (scientists call them "eukaryotic" cells — that's just the technical name for cells with a nucleus, which includes every cell in the human body). Mitochondria are often nicknamed the "powerhouses of the cell" because they produce ATP (adenosine triphosphate), the fuel our cells run on for everything from thinking to walking to healing.

How mitochondria make energy

Mitochondria make ATP through a process called oxidative phosphorylation — or "OxPhos" for short. Think of it as a tiny production line inside each cell, turning the food we eat and the oxygen we breathe into usable energy. (Watch a short animation here if you're curious how it works.)

A quick history of PEMF

Nikola Tesla didn't invent PEMF therapy, but his groundbreaking work on electricity and electromagnetic fields laid much of the scientific groundwork that made it possible. Pulsed Electromagnetic Field Therapy was first introduced in the late 1800s and has been used ever since as a drug-free option for arthritis, pain, insomnia, and general muscle and joint troubles.

In 1979, the US Food and Drug Administration (FDA) approved the use of electromagnetic fields to help heal fractures that weren't mending on their own. A decade later, that approval was extended to treating pain and swelling (known medically as oedema) in soft tissue.

Since then, a growing body of scientific research has continued to uncover encouraging findings about PEMF therapy.

A boost to general well-being

Most research on PEMF has focused on age-related issues like osteoarthritis, bone fractures, and soft-tissue healing. But along the way, something else has come up again and again in feedback from everyday users: a simple sense of feeling better overall.

Scientists now believe this may be because PEMF therapy stimulates oxidative phosphorylation inside mitochondria — helping to maintain what's called mitochondrial membrane potential (essentially, the electrical charge mitochondria need to keep functioning efficiently) and supporting healthy ATP production.

More energy at the cellular level

Between the science and the mountain of positive experiences shared by users, there's good reason to believe that using PEMF — such as with the Oska Pulse — can support well-being and help slow some of the effects of ageing.

About the Oska Pulse

The Oska Pulse is registered in Australia as a Class IIa medical device. Its job is simple: help your body do what it already knows how to do — heal — a little faster. Portable, wearable devices like this are becoming a genuine alternative to long-term reliance on painkillers. Learn more about the Oska Pulse here.

Let's look a little closer — meet the mitochondrion

Mitochondria (the singular is “mitochondrion”) are tiny structures found inside almost every cell in our body. Often called the cell's powerhouse, they play a starring role in turning the food we eat into usable energy.

Here are a few things worth knowing about them:

1. **Built for the job:** Each mitochondrion has two membranes — an outer one and an inner one — and the inner membrane folds in on itself many times, forming ridges called cristae. This folding gives it much more surface area to work with, a bit like crumpling a sheet of paper to fit more of it into a small box.
2. **Turning food into fuel:** A mitochondrion's main job is producing ATP through cellular respiration — breaking down glucose and other nutrients with the help of oxygen. Two key steps in this process, the electron transport chain and oxidative phosphorylation, happen inside the mitochondrion's inner membrane.
3. **Their own genetic material:** Mitochondria carry a small amount of their own DNA (called mtDNA), separate from the DNA in the cell's nucleus. Interestingly, this DNA is passed down only from mothers, not fathers.
4. **A role in cell renewal:** Mitochondria also help manage a natural process called apoptosis — essentially, the planned “retirement” of old or damaged cells. This is a normal and important part of keeping tissue healthy.
5. **Keeping things balanced:** Mitochondria are involved in several other everyday processes too, including regulating calcium (important for muscle movement and cell communication) and helping metabolise fats.
6. **When things go wrong:** If mitochondria aren't working properly — often due to inherited genetic changes — it can lead to health issues, particularly affecting energy-hungry organs like the brain, muscles, and heart.
7.

So, can PEMF help mitochondria make more energy?

PEMF therapy uses electromagnetic fields to support various functions within the body's cells. A growing body of evidence suggests it may help mitochondria work more efficiently, potentially boosting ATP production. Here's how researchers think it might work:

1. **Supporting the electron transport chain:** This is the name for the chain of protein complexes inside the mitochondrion that shuttle electrons around to produce ATP. PEMF may help these complexes function more efficiently, thereby supporting higher ATP output.
2. **Maintaining mitochondrial membrane potential:** This is the electrical charge across the mitochondrion's inner membrane — essential for the electron transport chain to do its job. PEMF has been shown in some studies to help support this.

3. **Making better use of oxygen:** PEMF may help cells use oxygen more effectively, which matters because oxygen is essential to how mitochondria generate ATP.
4. **Keeping the internal chemistry balanced:** PEMF may also help support what's called redox balance — the healthy give-and-take of electrons within cells — which can support energy production and help reduce oxidative stress (a kind of cellular wear and tear).
5.

In summary

A number of studies have examined how PEMF affects mitochondria and ATP production in both lab and animal studies. Some results have been really encouraging; others less conclusive. Researchers are still working out exactly which PEMF settings — frequency, strength, and duration — work best. It's an exciting area of research, and one we'll continue to watch closely.

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Reference:
Electromagnetic stimulation increases mitochondrial function in osteogenic cells and promotes bone fracture repair | Scientific Reports (nature.com)