

# NASA Study (Summary)

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NASA 4-year collaborative study on the efficacy of electromagnetic fields to stimulate growth and repair in mammalian tissues

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NASA'S CONCLUSIONS - PEMF PROVIDES:

GREATER CELL VIABILITY

ACCELERATED CELL GROWTH

BETTER ORGANIZED CELL MORPHOLOGY

INCREASED GENE EXPRESSION RELATED TO COLLAGEN PRODUCTION

INCREASED GENE EXPRESSION RELATED TO CELL RESTORATION AND GROWTH

BIOELECTRIC POTENTIATION OF NERVE STIMULATION AND RESTORATION

HIGH-SPEED SQUARE WAVE INCREASED CELL GROWTH BY FOUR-TIMES THE NORMAL HEALING SPEED

PURPOSE: This four year study used human donors "to define the most effective electromagnetic fields for enhancing growth and repair in mammalian tissues."

To utilize "nerve tissue which has been refractory to efforts to stimulate growth or enhance its repair regardless of the energy used." (all other tissues have demonstrated growth and repair stimulation with appropriate PEMF)

To define a PEMF technology that would "duplicate mature, three dimensional morphology between neuronal cells and feeder (glial) cells, which has not been previously accomplished."

RESULTS: The PEMF used in the study "caused accelerated growth rate and better organized morphology over controls", and resulted in "greater cell viability" (85% vs. 65%).

In the gene discovery array (chip technology that surveyed 10,000 human genes), the investigators found up-regulation of 150 genes associated with growth and cell restoration.

T. Goodwin (personal communication) "PEMF shut down each dysregulatory gene we studied".

NASAs CONCLUSION:

"The up-regulation of these genes is in no manner marginal (1.7-8.4 logs) with gene sites for collagen production and growth the most actively stimulated."

"We have clearly demonstrated the bioelectric/biochemical potentiation of nerve stimulation and restoration in humans as a documented reality".

"The most effective electromagnetic field for repair of trauma was square wave with a rapid rate of change (dB/dt) which saw cell growth increased up to 4.0 times."

They further noted that "slowly varying (millisecond pulse, sine wave) or non varying DC (CW lasers, magnets) had little to no effect."

Final Recommendation: "One may use square wave EM fields with rapid rate of change for":

- repairing traumatized tissues
- moderating some neurodegenerative diseases
- developing tissues for transplantation

\*the first study to clarify technologies and efficacy parameters for tissue growth and restoration

For brevity we reduced the 33 page technical paper to the above summary which we feel represents the essence of that communication. For those who wish to review the molecular and genetic portion of the report use the following link:" [http://ston.jsc.nasa.gov/collections/TRS/\\_techrep/TP-2003-212054.pdf](http://ston.jsc.nasa.gov/collections/TRS/_techrep/TP-2003-212054.pdf)