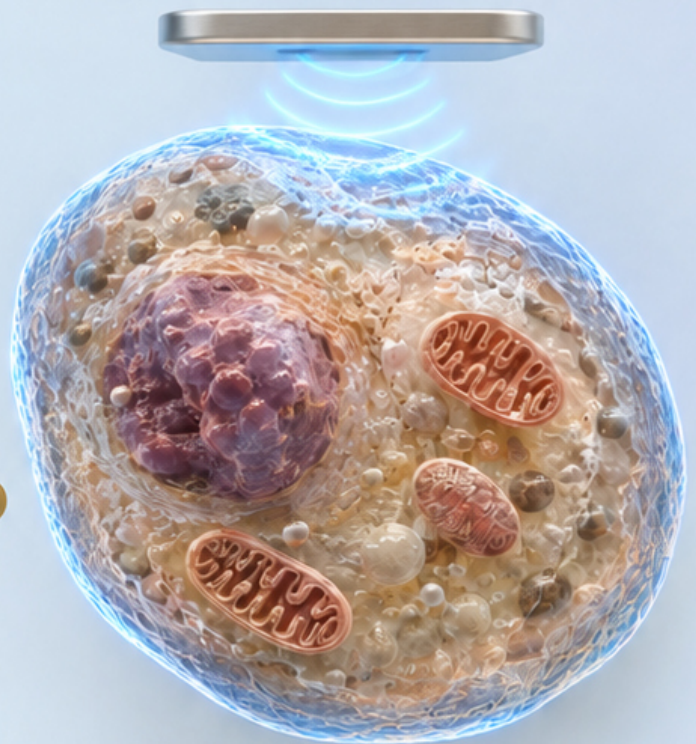


Evidence Overview



What does
the science
actually tell us?



Conceptual biological render; not to scale.

Physiology. Research. Perspective.

FrequencyFirst.

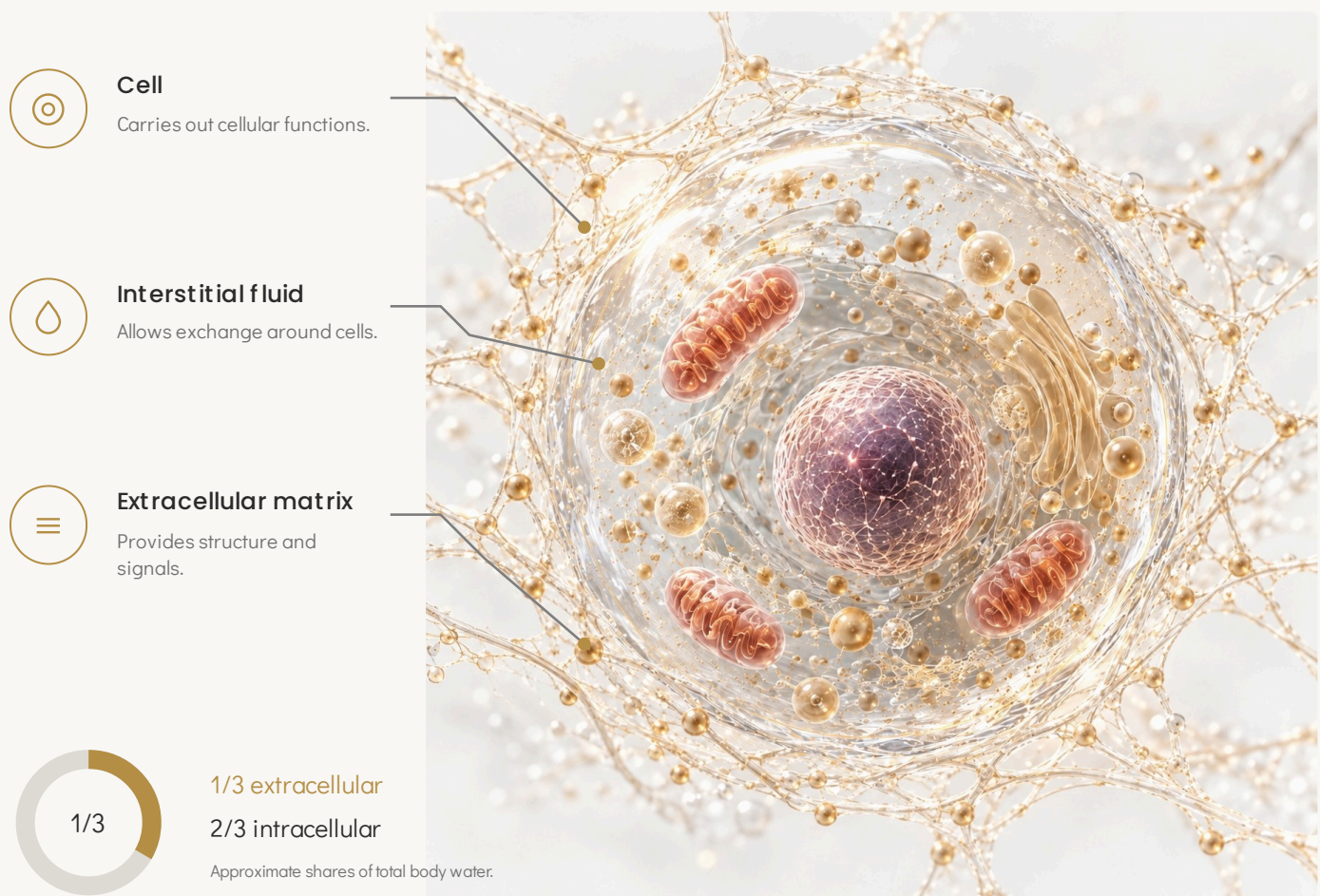
01.

The Cellular Environment

● Established physiology

Your cells don't float in nothing. Around one-third of total body water is extracellular.

That is roughly 14 litres in an adult. Most of it isn't blood. It is the fluid your cells actually sit in.



☐ **Cells read their surroundings.** Receptors on the cell surface (integrins) sense tension and pressure in the matrix and can change which genes the cell switches on. In plain terms: the environment tells the cell how to behave.

Water balance: Tobias, Ballard & Mohiuddin, *Physiology, Water Balance*, StatPearls (updated 2022). [\[source\]](#)

Mechanotransduction: Alenghat et al., *J Cell Biochem* (2009). [\[source\]](#)

02.

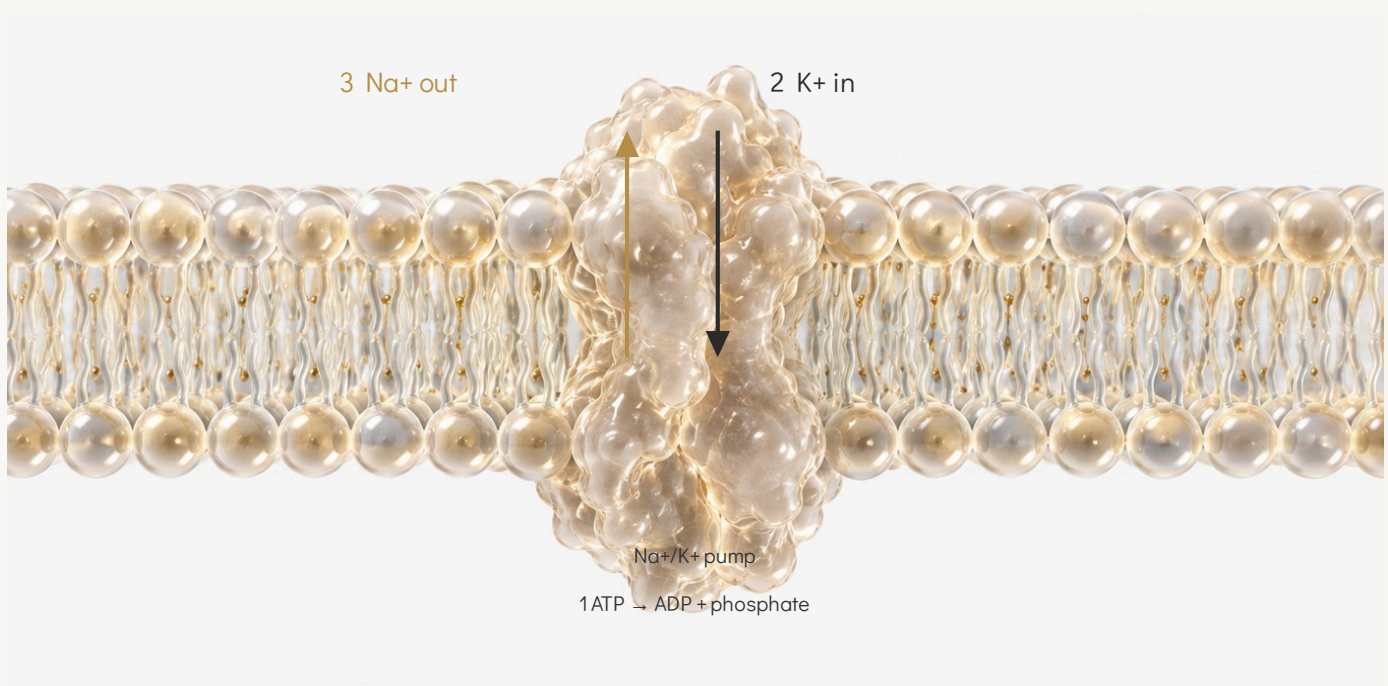
The Body Is Electric

Established physiology

Cells maintain electrical potentials. Electrical gradients and signalling are part of normal physiology.

OUTSIDE THE CELL

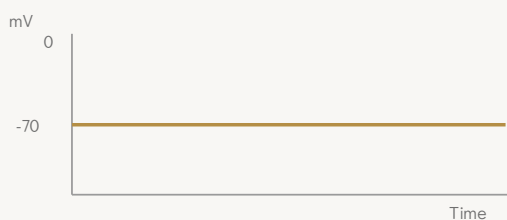
Relatively positive (+)



INSIDE THE CELL

Relatively negative (-)

Resting potential



≈ -70 mV in a typical neuron.

The pump maintains ion gradients; leak channels also shape resting voltage.



Injury creates a current. When skin is cut, the wound itself generates a tiny electric field, and repair cells follow it to where they are needed. This is one of the reasons scientists began asking whether small currents could influence how tissue heals.

Pump: [\[1\] NIH Physiome model](#) Resting potential: [\[2\] OpenStax A&P](#) Wound fields: [\[3\] Zhao, Semin Cell Dev Biol \(2009\)](#)

03.

Why Microcurrent Became Interesting

○ Animal / lab research

Cheng et al. (1982) reported a three- to fivefold rise in ATP in rat skin tissue at 50-1,000 μA .

Three reference points



Body's natural
bioelectric currents

~1-10 $\mu\text{A}/\text{cm}^2$ *



Cheng et al.
1982 study range

50-1,000 μA

Rat skin tissue



Standard
TENS units

~10,000-80,000 μA

Illustrative output range

An interesting biological finding.

What this shows.

Microcurrent can change how cells produce energy, at least in laboratory tissue.

What it doesn't show yet.

How much of that carries over to a person. That gap is exactly where current research is working, and it is why FrequencyFirst positions its Intelligent Bio-Frequency Technology as *support*, not *treatment*.



Membranes act as capacitors; resting voltage varies by tissue.

*Wound-current density, not total body current. Current density and device current are not directly comparable. TENS output varies by device, settings and load.

Cheng et al., *Clin Orthop Relat Res* (1982) [\[source\]](#)

Wound-current density: Rouabhia et al., *PLoS One* (2013) [\[source\]](#)

04.

What Has Been Studied in Humans?

○ Early human evidence

Studies of related microcurrent approaches, not FrequencyFirst.
Click any box below to open the original research paper.

1

Musculoskeletal pain

Systematic review and meta-analysis

4 RCTs and 5 non-randomised studies

Improved shoulder and knee pain vs sham. No effect on chronic low back pain.

○ Early evidence

Iijima & Takahashi, 2021 [\[source\]](#)

2

Exercise-related muscle soreness

Small controlled trials

n=30 (Lambert); n=35 (Curtis)

Curtis used frequency-specific microcurrent vs sham.

○ Early evidence

Lambert, 2002 [\[source\]](#) / Curtis, 2010 [\[source\]](#)

3

Muscle function

Randomised sham-controlled trial

n=38 older adults

Microcurrent applied alongside exercise.

○ Small study

Kwon et al., 2017 [\[source\]](#)

4

Stress and somatic symptoms

Pilot randomised trial, frequency-specific microcurrent

n=58 adults; four study arms

FSM alone and with relaxation vs relaxation alone and placebo.

○ Promising, limited

Pereira et al., 2025 [\[source\]](#)

□ Pilot studies guide larger trials; they do not establish efficacy. None of these trials used the FrequencyFirst device.

Want to go deeper?

Explore the original research.

Scan for six indexed papers. [Open the PubMed list](#). Study citations are also clickable.



Electrical Stimulation and the Gut

○ Adjacent human evidence

Randomised trials of frequency-based electrical stimulation across the abdomen. Related principle, different current range. Click any box to open the paper. Field review: Moore, Gibson & Burgell, 2018 [\[source\]](#)

1 Chronic constipation

Phase 3, multicentre, double-blind, sham-controlled
7 centres, France

Interferential current, 8-week stimulation period.

○ Strongest trial in this area

Vitton et al., 2023 [\[source\]](#)

2 Irritable bowel syndrome

Double-blind randomised, placebo-controlled
n=67 adults

Interferential current vs placebo stimulation.

○ Early evidence

Coban et al., 2012 [\[source\]](#)

3 Functional dyspepsia

Randomised, placebo-controlled
n=44 (23 treated, 21 placebo)

12 sessions over 4 weeks.

○ Small study

Köklü et al., 2010 [\[source\]](#)

4 Slow-transit constipation

Home use, one hour daily for six months
n=62 children

Adult sham-controlled pilot: Moore et al., 2020 [\[source\]](#)

○ Uncontrolled, long-term

Yik et al., 2017 [\[source\]](#)

A shared principle: frequency. A different intensity.

Interferential therapy

Crosses two medium-frequency currents (around 4,000 Hz) at milliamp intensity so they meet inside the tissue and produce a low-frequency signal.

Intelligent Bio-Frequency Technology

FrequencyFirst also runs two channels, one frequency chosen for the tissue and one for its condition, but delivers them directly at microamp intensity, within the body's own bioelectrical range and roughly a thousand times lower than the devices in these trials.

What these trials show: the gut responds to frequency-based electrical stimulation. **What they don't show yet:** the same response at microamp intensity. That trial has not been run, and none of these studies tested FrequencyFirst.

What science hasn't told us yet

No trials of Intelligent Bio-Frequency Technology, or of any microamp-level device, have been published for gut health, sleep or inflammation. Gut research so far has used higher-intensity stimulation, shown above.

○ Gut health ○ Sleep ○ Inflammation