

The integration of the Dual-Function Theory of Neural Computation and Conscious Electromagnetic Information as a framework to unify biofield and neuroscience theories

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Conference presentation · 15–18 minutes

HYPOTHESIS-DRIVEN

Frontiers provisional manuscript

The central question

Can EPI observations be linked to brain electromagnetic dynamics without overclaiming what the instrument measures?

What is established

- Neurons generate measurable electrical and magnetic fields.
- EEG/MEG capture population-level electromagnetic activity.
- Extracellular fields can influence neuronal membrane potential under some conditions.

What is emerging

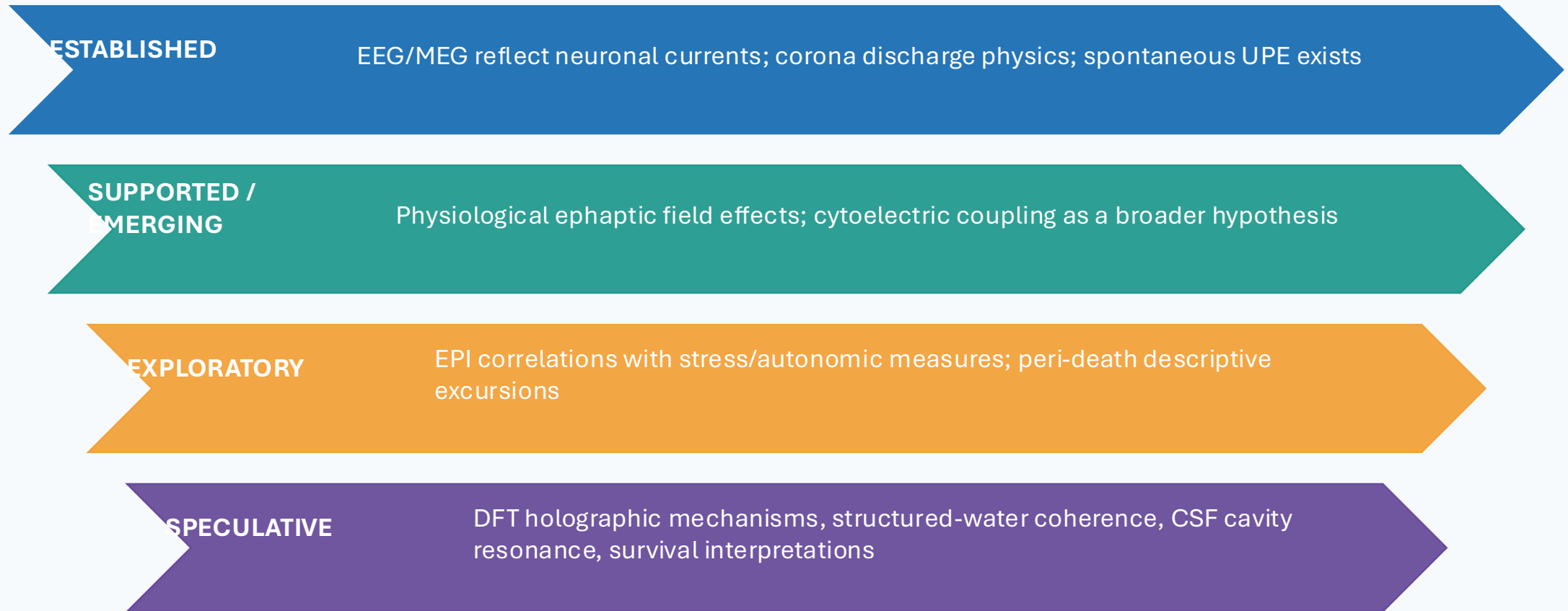
- Ephaptic and cytoelectric coupling motivate field-neuron interaction models.
- Peri-arrest studies report transient organized gamma activity in some animals and humans.
- Ultraweak Photon Emission (UPE) is measurable in biological tissue.

What is hypothetical

- Dual Function Theory (DFT) proposes a second, field-responsive integrative layer.
- Electro Photonic Imaging (EPI) may covary with physiological state but is not a direct brain-field sensor.
- Any peri-death EPI residual requires prospective multimodal testing.

Scientific posture: separate measurement, mechanism, and interpretation.

Evidence ladder: keep the layers separate



The proposed contribution is not to collapse these levels — it is to connect them with falsifiable tests.

UPE & the Biofield

Ultraweak Photon Emission (UPE)

Spontaneous light emission from all living systems ($\sim 10\text{--}10^3$ photons $\text{cm}^{-2} \text{s}^{-1}$) in 200–1000 nm range. Originates from reactive oxygen species (ROS) and metabolic reactions.

The Biofield

An ensemble of weak electromagnetic fields produced by biological tissues. Reflects cellular metabolism and stress responses; modulated by ROS and oxidative stress.

Salari, V., Seshan, V., Frankle, L., England, D., Simon, C., & Oblak, D. (2025). Imaging ultraweak photon emission from living and dead mice and from plants under stress. *The Journal of Physical Chemistry Letters*, 16(17), 4354-4362.

Ultraweak photon emission (UPE) and EPI are physically distinct

Spontaneous UPE

- Endogenous photon emission from oxidative/metabolic processes
- Approx. $10\text{--}10^3 \text{ photons}\cdot\text{cm}^{-2}\cdot\text{s}^{-1}$
- Requires sensitive photon-counting / EMCCD instrumentation
- Live vs dead mice and stressed plants show measurable differences

Key point: no external high-voltage stimulation is required.

EPI / GDV corona discharge

- Externally induced gas ionization
- High-voltage stimulus drives a bright corona
- Standard CCD imaging is sufficient
- Output strongly depends on interface + environment

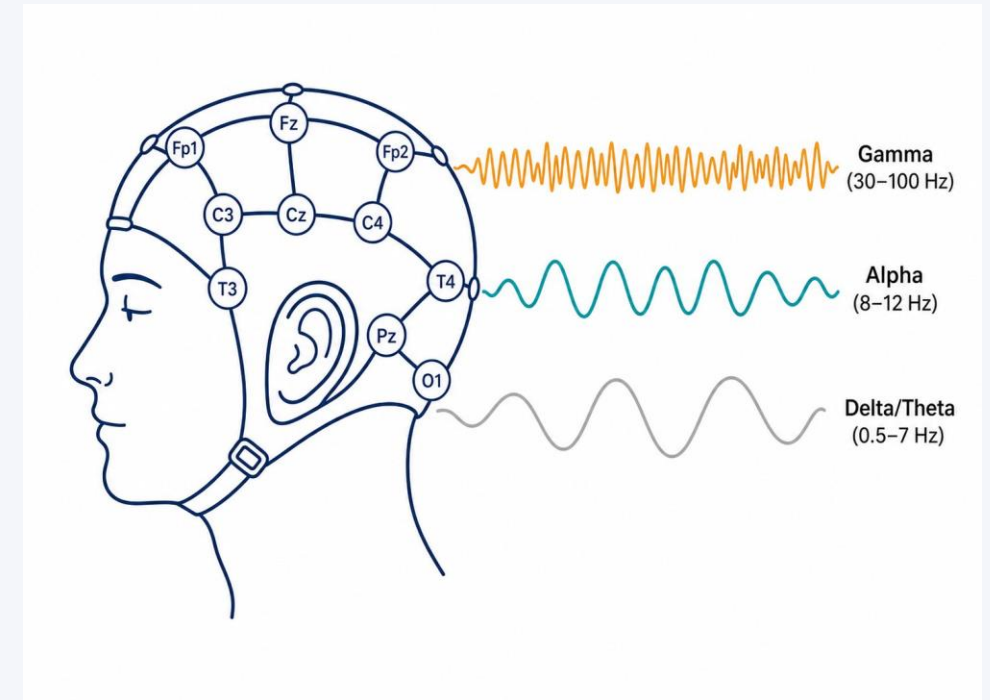
Key point: EPI cannot be equated with spontaneous biophoton emission but there is evidence that EPI is also related to stress measurements and death process.

Researchable question $\neq$ assumed identity

THE BROADER LANDSCAPE

Two rich, independent literatures — brain electromagnetic dynamics and biophotonic imaging — have never been formally connected.

- The brain generates measurable electromagnetic fields via **EEG/MEG oscillations**, ephaptic coupling, and endogenous light emission at the cellular level
- **Gamma oscillations (30–100 Hz)** correlate with consciousness, cognition, and — critically — have been documented at elevated levels near cardiac arrest in rodents and humans
- **Electrophotonic Imaging (EPI/GDV)** captures high-voltage corona discharge at the fingertip; it is commercially approved in Russia as a wellness measurement device
- The **gap**: no theoretical framework links EEG/EM brain dynamics to peripheral EPI readings — this paper proposes one



Dual-Function Theory



Biofield

Weak endogenous electromagnetic fields generated by tissues; shaped by vicinal water; amplify low-frequency oscillations and bridge biochemical events with field dynamics.



The **Dual Function Theory** proposes that the brain does not work in just one way — it works in **two interconnected systems at the same time**.



Cavaglià, Marco, and Jack A. Tuszynski. "A Unified Holographic Framework for neural computation and consciousness: From lipid membranes to the Schumann resonance." *BioSystems* (2025): 105669..

Dual-Function Theory



the “classical brain”

This is the part of the brain we already know well:

Uses **neurons, synapses, and electrical signals**

Works through **fast, local communication**

Controls things like:

- thinking
- movement
- perception
- decision-making



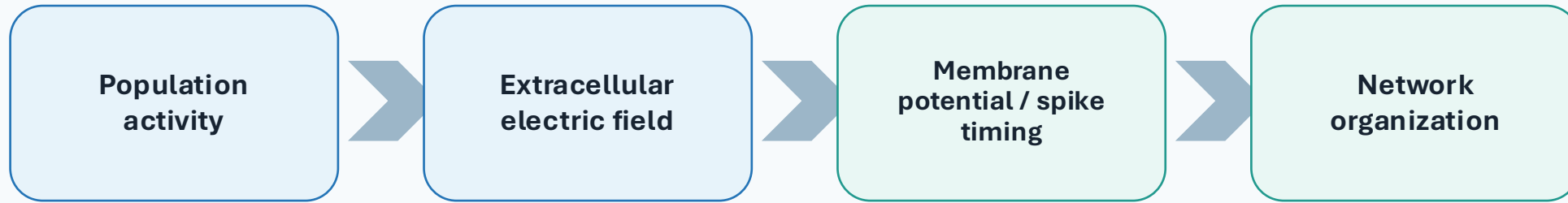
Field-responsive

Uses **fields and wave-like processes**. Lipid membranes, water & cerebrospinal fluid (CSF); slow, holistic integration via endogenous fields; global (whole-brain) way.

Phase Alignment

Consciousness arises when slow coherent dynamics of the field-responsive layer synchronise with fast membrane computations. The brain “thinks locally” but “understands globally”

Field–neuron interaction: from ephaptic coupling to cytoelectric hypotheses



Ephaptic coupling

Demonstrated experimentally: weak extracellular fields can shift membrane potential and entrain spikes, especially at slow frequencies.

Cytoelectric coupling

Broader proposal: fields may sculpt ensemble activity and influence cellular infrastructure. Interesting, mechanistically richer — and still requiring direct validation.

Anastassiou et al. 2011, Nature Neuroscience 14:217–223; Pinotsis, Fridman & Miller 2023, Progress in Neurobiology 226:102465.

TWO FUNCTIONAL LAYER

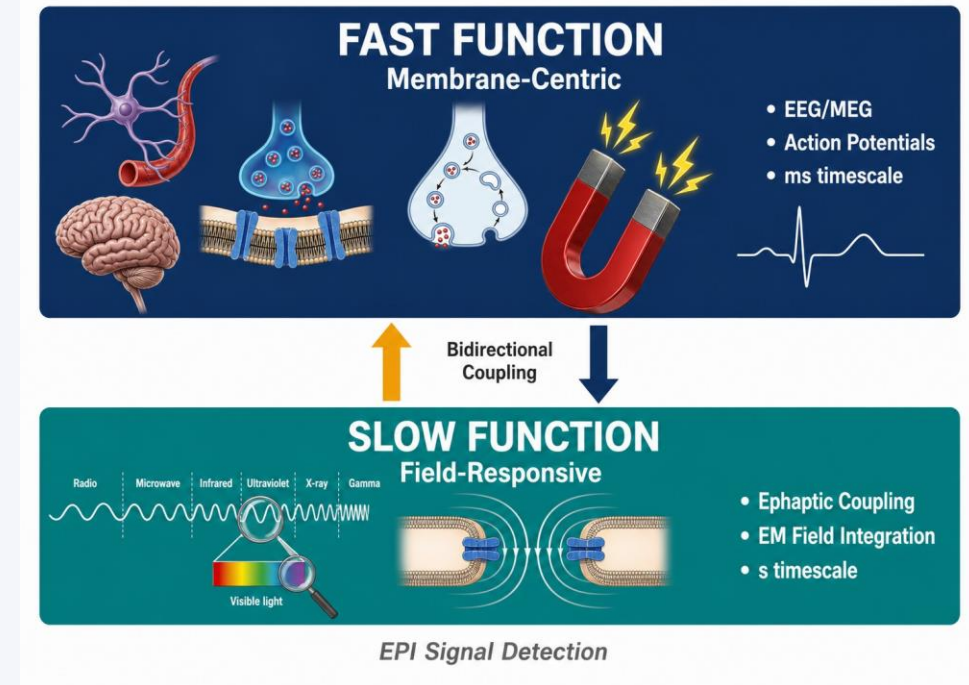
FAST LAYER

Membrane-centric | Action potentials | Millisecond timescale
| Classical spike-coded information processing

SLOW LAYER

Field-responsive | Ephaptic coupling | Seconds timescale |
Endogenous EM fields modulate neural ensembles collectively

DFT as a bridge: The SLOW layer's EM field dynamics could propagate to the periphery — making EPI a candidate readout of endogenous brain EM activity



THE GAP

No Bridge Exists

- EPI/GDV captures a measurable, real-time peripheral signal from living organisms
- Brain EM dynamics are well-documented but studied in isolation from biophotonic signals
- No validated theoretical model links the two domains

THE OBSERVATION

Peri-Death EPI Surge

- EPI Energy exceeded each participant's own prior-3-observation mean at or near the cardiac death marker in all 3 palliative-care cases (n=3)
- +18.2%, +18.9%, +27.1% — purely descriptive, not statistically inferred
- Parallels post-mortem gamma surge literature in humans (Xu et al., 2023)

THE CENTRAL QUESTION

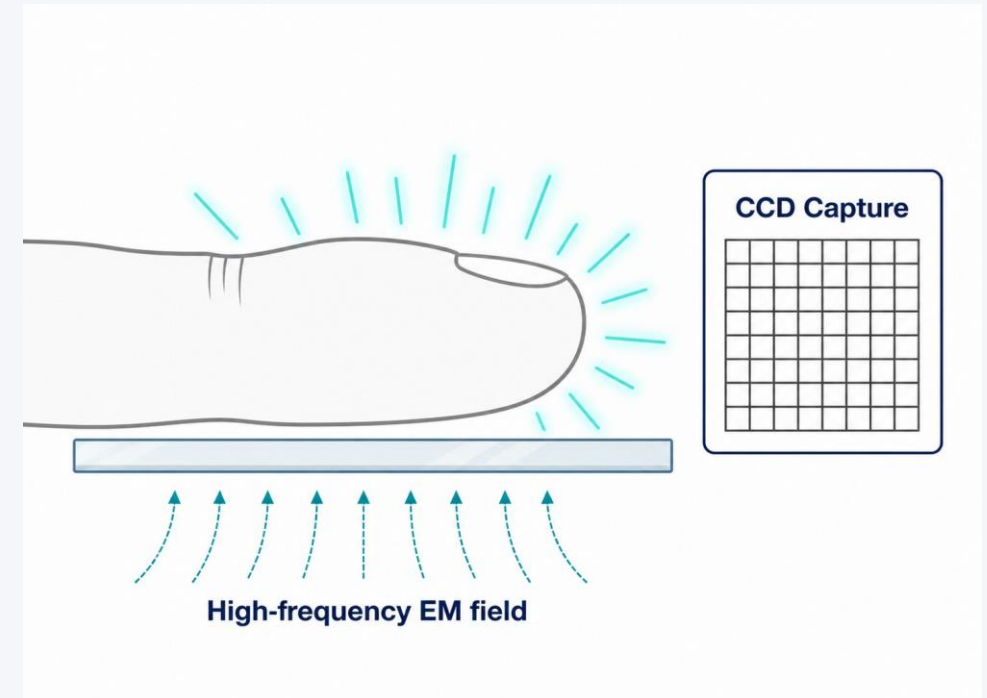
Can DFT Bridge Them?

- Could Dual Function Theory explain why a peripheral optical signal might co-vary with endogenous brain EM activity?
- This paper formulates nine testable hypotheses — it does NOT test them
- First step: establish a theoretically coherent, empirically falsifiable framework

WHAT WAS OBSERVED

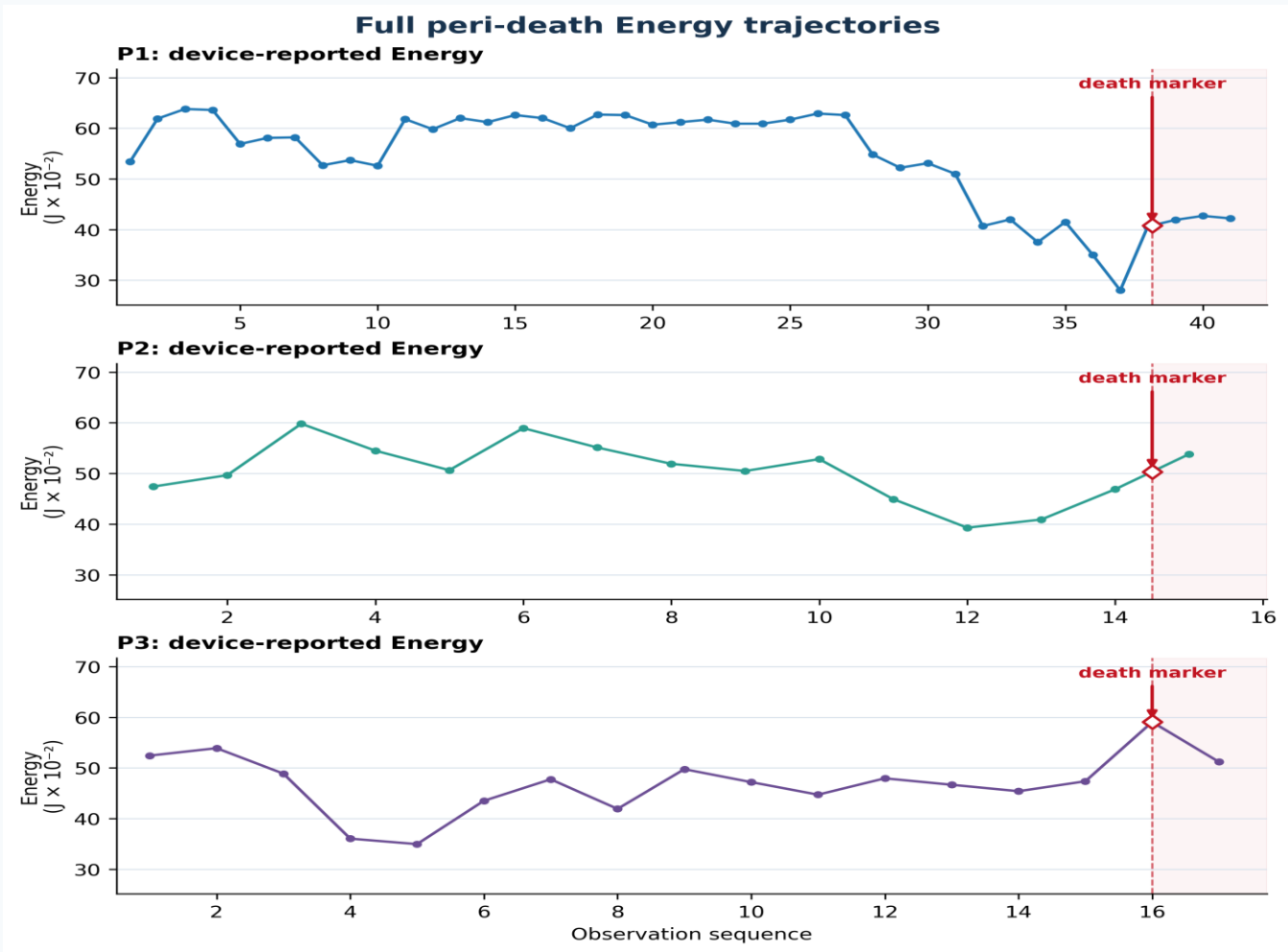
- **Participant 1 (P1):** 38 pre-death EPI observations (GDV glove, continuous mode); prior-3 mean = 34.53 ± 6.31 ; EPI Energy at marker = 40.81
- **Participant 2 (P2):** 14 pre-death observations (fingertip); prior-3 mean = 42.34 ± 4.00 ; EPI Energy at marker = 50.34; 1 post-death observation
- **Participant 3 (P3):** 15 pre-death observations (fingertip); prior-3 mean = 46.47 ± 0.99 ; EPI Energy at marker = 59.05; 1 post-death observation
- In all 3 cases the death-marker measurement exceeded the individual's own prior-3-observation baseline — a consistent directional pattern

Important context: These are descriptive case observations, not a controlled experiment. No statistical inference was conducted. The sample ($n=3$) is too small for any generalisation.



Preliminary peri-death EPI observations

Three participants; feasibility signals only



Acquisition

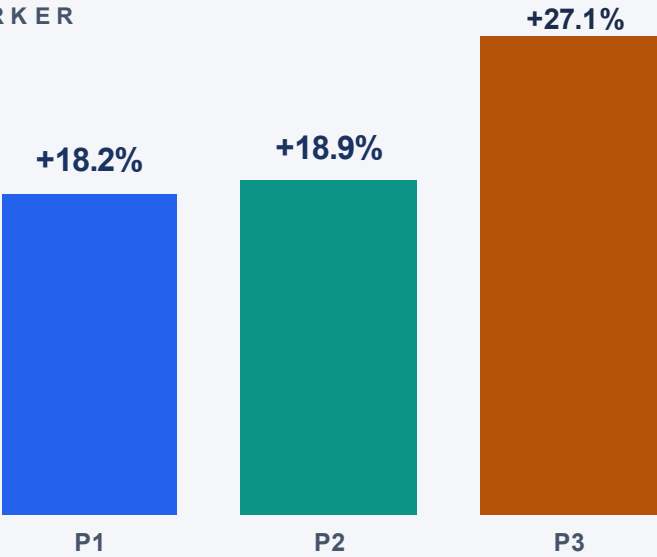
- P1: continuous glove mode (41 observations)
- P2: fingertip mode (16 observations)
- P3: fingertip mode (17 observations)

Same device; calibration was performed.

Critical limitations

No simultaneous EEG, ECG, respiration, skin conductance or environmental streams; unequal sampling; sparse post-marker data; no control group; no preregistration.

% DEVIATION FROM PRIOR-3 MEAN AT DEATH MARKER



Bars proportional to % increase (max = P3, 27.1%)

TABLE 1 SUMMARY

Part.	Pre-n	Prior-3 Mean +/- SD	Marker Value	Change
P1	38	34.53 +/- 6.31	40.81	+18.2%
P2	14	42.34 +/- 4.00	50.34	+18.9%
P3	15	46.47 +/- 0.99	59.05	+27.1%

Descriptive data only. No inferential statistics. n=3 — pattern is consistent but not generalisable. P1: GDV glove (continuous); P2 & P3: fingertip method.

Why the preliminary pattern is not yet interpretable

Any EPI excursion can arise from multiple coupled processes:

Skin / interface

sweat, hydration, temperature, edema, contact pressure

Environment

humidity, ambient temperature, condensation, electrical noise

Device

pulse parameters, calibration, software correction, drift

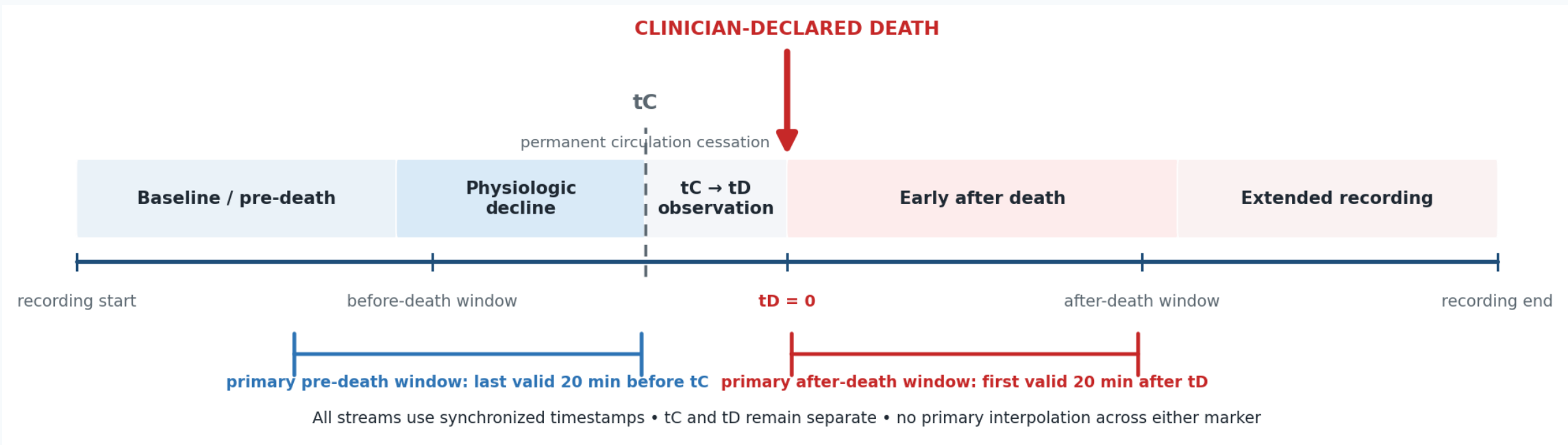
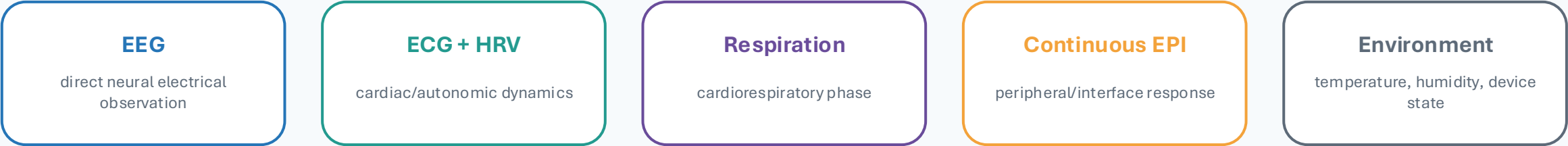
Physiology

autonomic tone, circulation, respiration, peripheral conductivity

Neural activity

EEG organization or field-sensitive dynamics — unmeasured here

Prospective multimodal design: measure the competing explanations



Primary alignment: independently recorded permanent circulation cessation (tC) and clinician-declared death (tD=0) remain separate; no interpolation across either marker.

PRIMARY CHAIN (H1–H4)

- H1 Cardiorespiratory coupling:** HRV/respiratory rate predict EEG spectral power in near-death contexts
- H2 EEG to EPI pathway:** EEG spectral measures predict EPI Energy beyond physiological covariates
- H3 Multimodal change point:** EEG, cardiac, and EPI signals exhibit simultaneous change points at death marker
- H4 Null hypothesis:** Post-death EPI change is fully explained by physical decay processes
— no residual biogenic signal

EXPLORATORY (H5–H9)

- H5 Slow dynamics:** Slow-band EEG predicts slow trends in EPI Energy over minutes-long windows
- H6 Laterality:** EPI left-right asymmetry correlates with EEG hemispheric laterality indices
- H7 Gamma-EPI co-occurrence:** Transient EPI energy surges coincide with gamma burst events
- H8 Peri-death predictors:** Pre-death EPI Energy level predicts post-death EPI level
- H9 Meditation modulation:** Contemplative states modulate EPI-EEG coupling strength

AUTHORS' STATED LIMITATIONS

- Extremely small sample (n=3); purely hypothesis-generating — no statistical power for any inference
- No concurrent EEG recording in the preliminary data — the core EEG-EPI link (H1–H7) has not been directly tested
- Mixed EPI methods across participants (glove vs. fingertip) reduce comparability

ADDITIONAL METHODOLOGICAL CONSIDERATIONS

- ! No control group or matched comparators — alternative explanations (skin conductance, temperature, movement artifacts) for the EPI pattern are untested

- ! Death marker operationalisation (cardiac arrest time) may not align with neurological death — EEG might have already ceased

EPI/GDV measurement standardisation, reproducibility, and validated psychometric properties remain contested in the literature

Note: Additional considerations are reviewer/audience inferences, not stated by the authors.

GAMMA SURGE LITERATURE

BORJIGIN ET AL., 2013 (PNAS)

Rodent Model

Surge of highly synchronised gamma oscillations immediately after cardiac arrest in rats — first controlled demonstration

XU ET AL., 2023 (PNAS)

Human Evidence

Gamma and other high-frequency activity surges documented in dying human patients — extends the phenomenon to clinical context

EPI IN THIS CONTEXT

- If brain gamma activity surges near death, and if the SLOW DFT layer propagates EM dynamics peripherally, EPI may capture an indirect echo of that surge
- H7 formalises this as a testable prediction: transient EPI energy surges should coincide temporally with gamma burst events in simultaneous EEG
- The peri-death EPI increases in this paper (+18–27%) are consistent with this hypothesis
— but cannot confirm it

WHAT THE DATA DOES SHOW

- In palliative-care cases, EPI Energy at the cardiac death marker exceeded each individual's own prior-3-observation baseline
- EPI after death pattern (+18.2%, +18.9%, +27.1%) is consistent across all participants despite different measurement methods
- Observations are broadly consistent with DFT's prediction that peripheral EM activity co-varies with endogenous brain EM dynamics

WHAT THE DATA DOES NOT ESTABLISH

- Observations do NOT prove any causal or mechanistic link between brain EM activity and EPI readings
- $n=3$ samples does NOT support statistical inference or generalisation to any population
- EPI surge does NOT rule out confounds: electrode-skin interface changes, movement artifacts, temperature, or physical post-death processes
- No current EEG was recorded in these 3 cases — the EEG-EPI link in H1–H7 remains entirely untested empirically



Theoretical

- Provides the first formal theoretical bridge between endogenous brain EM dynamics and peripheral biophotonic signals
- Frames EPI/GDV from a phenomenological instrument to a theoretically-grounded neuroscience tool
- Open dialogue between consciousness science, biophysics, and integrative medicine
- It positions ephaptic coupling as a candidate mechanism for mind-body field interactions



Methodological

- It could serve as a low-cost, non-invasive, real-time complement to EEG in research settings
- Simultaneous EPI+EEG+cardiac recording protocol offers a novel multimodal approach for studying altered states
- Hypothesis-driven EPI research may rehabilitate the technique's scientific credibility
- Standardization of EPI methods (glove vs. fingertip) is a prerequisite for cross-study comparison



Clinical / Palliative

- Once validated, EPI monitoring could provide continuous, non-invasive peri-death physiological tracking in comfort-focused settings
- Better understanding of the dying process — consistent with palliative care's holistic orientation
- Clinical application is conditional on rigorous hypothesis testing first — these are speculative directions, not ready recommendations

1

A Theoretically Grounded Bridge

Dual Function Theory provides the first formal framework linking endogenous brain EM dynamics to peripheral EPI/GDV signals — moving EPI from phenomenology to testable neuroscience

2

A Consistent Descriptive Pattern

EPI Energy exceeded individual baselines at the death marker in all 3 palliative-care cases (+18–27%) — consistent across participants but not statistically inferable from $n=3$

3

Nine Falsifiable Hypotheses

H1–H9 constitute a testable research programme; the primary chain (cardiorespiratory → EEG → EPI → multimodal change point) is ready for systematic empirical investigation

If the electromagnetic field of the dying brain leaves a peripheral signature,
EPI may one day let us listen to what the body whispers at the threshold.

Selected references & research verification

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Primary presentation source: Valverde, Korotkov, Swanson & Hamilton — provisional Frontiers manuscript supplied for this presentation.