



Light remains the primary zeitgeber.

Proposed Weak Magnetic Co-Zeitgeber Pathway

Light as the dominant zeitgeber; non-native EMF as a candidate phase-biased co-modulator of spin-sensitive and redox-calcium timing systems



Proposed mechanistic integration
Biologically grounded synthesis;
not settled proof

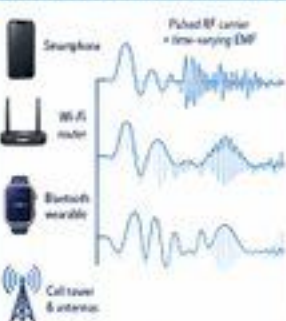
1. Light: the dominant zeitgeber

Master circadian anchor

- Sets phase
- Synchronizes periphery
- Stabilizes metabolism & repair



2. Non-native EMF: candidate weak magnetic co-zeitgeber / chronodisruptor

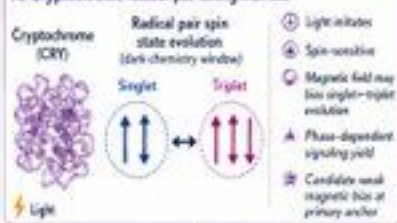


- Not equivalent to light
- Potential phase-dependent timing bias
- Low-fidelity / incoherent timing noise
- Carrier + low-frequency modulation

Key framing: Light remains the dominant zeitgeber. Non-native EMF is shown here as a candidate weak co-modulator or chronodisruptor, not a replacement for light.

3. Timing-sensitive molecular interfaces

A. Cryptochrome radical pair timing interface



B. CYB5B redox-calcium timing interface

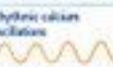


C. Timing fidelity node



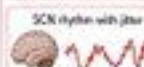
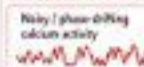
4. Signal-to-noise ratio determines biological stability

High-fidelity biological timing



- High circadian phase coherence
- Coherent circadian phase
- Strong temporal alignment
- Metabolic, immune, and repair programs in sync

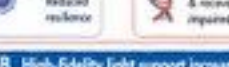
Low-fidelity biological timing



- Reduced phase coherence
- Chronodisruption
- Phase drift
- Weak temporal coordination
- Biological dissonance

5. Outcomes & mitigation

5A. Desynchronization phenotype



Mitigation, not complete cure: Light optimization raises signal-to-noise and coherence, but does not fully reverse the underlying non-native EMF noise.

LEGEND (arrow coding)

- Activation / stimulation
- Inhibition / suppression
- Modulation / influence
- Feedback / integration

PATHWAY SUMMARY

- Light is the dominant zeitgeber and master circadian anchor.
- Cryptochrome radical-pair mechanisms show magnetic sensitivity in model systems.
- CYB5B is emerging as an EMF-responsive redox-calcium timing interface.
- The weak co-zeitgeber / chronodisruptor model is proposed here, not proven in humans.

EVIDENCE FRAMING (state of knowledge)

- Established: Light as the dominant zeitgeber
- Supported in model systems: Cryptochrome radical-pair magnetic sensitivity
- Emerging: CYB5B as an EMF-responsive redox-calcium interface
- Proposed here: Weak magnetic co-zeitgeber / chronodisruptor model for biological timing