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The Global Inter-Brain State Hypothesis: An Evidence-Informed Framework for Interpersonal Brain-State Coupling and Potential Non-Sensory Information Transfer

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Abstract:

- ***Background:***

Human beings influence one another's emotional, cognitive, and physiological states. Social neuroscience has documented inter-brain coupling during interaction, while research on anomalous perception has investigated whether information can be identified without recognised conventional sensory access. These findings do not establish a shared human consciousness or direct communication between isolated brains.

- ***Purpose of the Project:***

The Global Inter-Brain State Hypothesis (GISH) proposes that human beings form an interconnected social and biological network in which brain and bodily states can become correlated through established mechanisms. It further asks whether a reproducible, information-specific effect could persist when known sensory and behavioural pathways are rigorously excluded.

- ***Proposed Mechanism***

GISH distinguishes established interpersonal coupling from a hypothetical non-sensory information transfer effect. Mainly electromagnetic fields are considered a measurable physical phenomenon and a candidate mechanism for investigation, but we proposed that electromagnetic brain-to-brain information transfer may be demonstrable. Similarly, quantum mechanics provides the fundamental framework for physical processes but we try to propose how itself, it establish a communication channel between brains. The concept of an aura is treated as an exploratory term for a proposed measurable physical signature rather than a proven independent energy field.

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➢ ***Methods Proposed:***

A preregistered, double-blind, randomised sender–receiver experiment could test the primary hypothesis using objective target identification, validated sensory isolation, environmental monitoring, prespecified statistical analyses, and independent replication. Mechanism-specific investigations should follow only if an information-specific effect is reproducibly demonstrated.

➢ ***Conclusion:***

GISH is a provisional, falsifiable research hypothesis rather than an established scientific theory. Its scientific value depends on distinguishing known interpersonal coupling from unexplained effects and requiring reproducible evidence before accepting a novel communication mechanism.

➢ ***Significance of the Research Project:***

The review therefore supports a distinction between established interpersonal coupling and the hypothetical possibility of information transfer without recognised sensory communication. It identifies a need for preregistered, adequately powered experiments with rigorous sensory isolation, objective target identification, prespecified statistical analyses, and independent replication.

Keywords: *Anomalous Perception; Aura; Global Inter-Brain State Hypothesis; Hypothesis Paper; Inter-Brain Coupling; Electromagnetic Fields; Quantum Information; Sensory Isolation.*

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I. INTRODUCTION

Human brains operate within complex social and environmental networks. Speech, facial expressions, posture, movement, shared attention, and common environmental events can influence the emotional and physiological states of other people. Hyperscanning studies, which record activity from two or more brains simultaneously, have documented inter-brain coupling during social interaction. However, correlated brain signals do not necessarily establish direct communication between brains because shared sensory inputs, coordinated behaviour, and common task demands can generate similar patterns [1].

A separate research tradition has investigated anomalous perception, including experiments in which participants attempt to identify information without recognised conventional sensory access. Some studies and meta-analyses report abovechance performance, whereas replication difficulties and methodological interpretations remain contested [2–4]. Even a reproducible effect would not automatically establish telepathy, a global consciousness, or a particular physical mechanism.

The Global Inter-Brain State Hypothesis (GISH) is proposed as a framework for examining these questions. Its starting point is that interpersonal brain-state correspondence should first be explained through established biological, behavioural, and environmental mechanisms. The more speculative question is whether an additional, information-specific effect could remain when these known pathways are rigorously controlled [1-4].

The term global refers to the potential interconnectedness of human beings through social, biological, and environmental networks. It does not imply that humanity has been demonstrated to possess a single unified consciousness. Similarly, inter-brain state refers to measurable relationships between neural or physiological states, not an assumption that two individuals literally share thoughts.

GISH also considers whether electromagnetic physics, quantum principles, and the popular concept of an aura could inform future mechanistic research. These concepts have different evidential statuses and must not be treated as interchangeable explanations. Electromagnetic fields and quantum phenomena are established aspects of physical science; direct non-sensory information transfer between isolated human brains is not established by their existence [5-10].

➢ *Aim and Research Questions*

The primary aim is to formulate a testable framework for determining whether information-specific interpersonal correspondence can occur when conventional sensory communication is rigorously excluded.

The secondary objectives are to:

- Distinguish ordinary interpersonal synchrony from a potential information-specific effect under sensory isolation.
- Determine whether any reproducible effect varies predictably with distance or measurable physical conditions.
- Establish whether a putative effect concerns broad emotional categories or specific target information.
- Evaluate whether electromagnetic measurements can explain any replicated effect better than conventional alternatives.

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- Define what additional evidence would be required before considering quantum-mediated or aura-related explanations.

➢ *Formulation of the Hypothesis*

- *Primary Hypothesis*

✓ Primary hypothesis: Interpersonal brain-state correspondence is primarily attributable to established sensory, behavioural, social, and environmental pathways. GISH further predicts that, if a nonsensory, information-specific effect exists, receivers will identify a sender's randomly selected target more accurately than the pre-specified chance level under rigorously controlled sensory isolation conditions. This prediction does not assume that such an effect exists or specify its mechanism in advance.

- *Null Hypothesis*

✓ H_0 (null hypothesis): Under rigorously controlled sensory-isolation conditions, receiver accuracy in identifying the sender's randomly selected target will not exceed the prespecified chance level.

- *Alternative Hypothesis*

✓ H_1 (alternative hypothesis): Under rigorously controlled sensory-isolation conditions, receiver accuracy in identifying the sender's randomly selected target will exceed the prespecified chance level by the minimum effect specified before data collection. Any positive finding must withstand the preregistered analysis, checks for sensory leakage and procedural or analytical bias, and independent replication.

- *Mechanistic Hypothesis*

✓ H_2 (mechanistic hypothesis): Only if an information-specific effect is independently replicated should researchers test whether its magnitude changes predictably with a prespecified, measurable physical variable or validated experimental manipulation. Electromagnetic interaction is one candidate pathway; a quantum-based explanation is more speculative. Neither mechanism should be accepted without distinct, falsifiable predictions and supporting empirical evidence.

➢ *Scope and Limitations*

GISH does not assume that all people are continuously connected through a universal field, that thoughts are routinely shared, or that subjective intuition reliably reveals distant events. Nor does it equate synchrony during ordinary social interaction with non-sensory information transfer. These are distinct claims requiring different evidence.

➢ *Chronological Review of Relevant Literature*

- *1976: Corona-Discharge Photography and the Interpretation of Aura*

Pehek and colleagues examined images produced through Kirlian-style corona-discharge photography [5]. Their analysis showed that image characteristics can be influenced by ordinary physical factors, including moisture and the electrical conditions of the recording arrangement.

This work is relevant because a visible glow around a person or object does not, by itself, establish a distinct field carrying emotions or thoughts. For GISH, the term aura should be operationally defined through specific measurements rather than assumed to represent a separate informational energy.

- *1994: Early Evidence Reported in Anomalous-Perception Research*

Bem and Honorton reviewed ganzfeld experiments and reported findings they interpreted as supportive of anomalous information transfer [2]. Ganzfeld procedures aim to reduce ordinary perceptual distractions, providing an experimental approach to investigating claims of perception without recognised conventional sensory access.

This work illustrates how unusual claims can be formulated as measurable outcomes. Nevertheless, the reported findings do not independently establish a new physical communication channel, eliminate all possible methodological explanations, or identify a mechanism.

- *1999: Replication Challenges in Ganzfeld Research*

Milton and Wiseman subsequently analysed 30 ganzfeld studies from seven laboratories and reported that their analysis did not confirm the principal above-chance effect under investigation [3]. Their findings highlighted the importance of reproducibility and the need to evaluate positive reports alongside unsuccessful replication attempts.

GISH must therefore treat anomalous-perception findings as contested rather than conclusive. A credible claim requires transparent methods, adequate statistical power, prespecified analyses, and independent replication.

- *2002: The Biofield Concept*

Rubik discussed the biofield hypothesis as a conceptual framework for considering possible field related processes in living systems [6]. This work provides historical context for field-based interpretations of biological organisation, but it does not establish that a distinct human biofield transmits thoughts or emotions.

Within GISH, biofield and aura should remain hypothesis-generating terms. Any proposed field must have a measurable definition, a plausible source, a potential receiver mechanism, and a testable relationship with information transfer.

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- *2005: Quantum Entanglement and Communication*

Cerf and colleagues examined the theoretical properties of quantum entanglement and communication [7]. Quantum mechanics permits correlations that do not have direct classical analogues, but entanglement alone does not provide a controllable messaging channel.

This distinction is fundamental to GISH. Quantum phenomena are established features of physics; quantum mediated interpersonal mental-information transfer is not. A quantum-based hypothesis would need to specify the relevant physical states, explain how information becomes accessible to a receiver, and predict an outcome that distinguishes the proposed model from classical alternatives.

- *2018: Nonsynaptic Communication within the Brain*

Agnati and colleagues reviewed proposed non-synaptic modes of communication within the nervous system, including electromagnetic fields and chemical factors such as oxygen and carbon dioxide [8]. This literature broadens the discussion of how neural activity may interact beyond a purely point-to-point synaptic model.

However, processes within one nervous system cannot automatically be extrapolated to communication between separate individuals. GISH must establish evidence for an external interpersonal pathway rather than infer it from the existence of non-synaptic mechanisms within the brain.

- *2021: Electromagnetic Brain-to-Brain Communication as a Hypothesis*

Hosseini proposed a possible role for brain electromagnetic fields in brain-to-brain communication and discussed candidate biological mechanisms [9]. This paper is directly relevant to GISH because it attempts to connect a measurable physical phenomenon with a potential interpersonal pathway.

Its evidential status must be stated carefully: it is a hypothesis paper, not definitive experimental confirmation that one person's brain field transmits meaningful information to another person's brain. The proposed pathway would require quantitative measurements of field strength, frequency, distance dependence, receiver sensitivity, and information-specific effects.

- *2023: Quantifying Inter-Brain Coupling*

Hakim and colleagues reviewed methods used to quantify inter-brain coupling in hyperscanning studies [1]. Their review identified substantial methodological variation across the literature, emphasising the importance of how coupling is measured and interpreted.

Inter-brain coupling supports the scientific study of relationships between neural states during social interaction. It does not, by itself, demonstrate direct brain-to-brain transfer or sensory-independent communication. Common inputs, coordinated behaviour, shared timing, and analytical decisions must be considered.

Hunt and Jones also examined competing interpretations of neural signalling and electromagnetic field theories [10]. Their discussion is relevant to the broader debate about the role of electromagnetic fields in neural function. Even if endogenous electromagnetic fields contribute to neural processing within an individual, that would not establish that fields from one person's brain can transmit information to another person's brain at a distance.

- *2024: A Recent Meta-Analysis of Anomalous Perception*

Tressoldi and Storm reported a small average effect in a meta-analysis of ganzfeld anomalous perception studies, with an estimated effect size of approximately 0.08 and a reported confidence interval of approximately 0.04–0.12 [4]. Their analysis reported results above chance, but the broader field remains disputed, and the findings do not identify a physical mechanism.

The appropriate interpretation for GISH is that the literature provides a rationale for rigorous investigation, not definitive proof of non-sensory communication. Preregistration, transparent data, complete reporting of null findings, and independent replication are essential.

➢ *An Integrated Explanatory Model for Gish*

- *Level 1: Established Sensory and Social Communication*

Individuals continuously exchange information through recognised sensory and behavioural pathways. Speech, facial expressions, body language, movement, touch, smell, and environmental cues can influence another person's emotions, attention, and physiological state. Subtle cues may be processed without conscious awareness. Consequently, an experience of intuition or emotional connection does not necessarily imply communication outside the senses. Coincidence, selective memory, expectation, and retrospective interpretation must also be considered.

- *Level 2: Inter-Brain and Physiological Synchrony*

Two people interacting may exhibit temporally related neural, autonomic, or behavioural patterns. Such correspondence can arise through reciprocal interaction or exposure to common events. GISH incorporates inter-brain synchrony as an established research domain but distinguishes it from nonsensory information transfer. Synchrony alone does not demonstrate that one person's thoughts have been transmitted directly to another person's brain [1].

- *Level 3: Electromagnetic Coupling as a Candidate Mechanism*

Electromagnetic fields arise from electrical activity, including neural activity. These fields are measurable, and electromagnetic stimulation can influence nervous-system activity under defined conditions. The unproven step is whether naturally generated fields from one person's brain can convey meaningful information to another person's brain at a distance under sensory isolation [8-10].

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For an electromagnetic version of GISH to become plausible, it would need to satisfy five requirements:

- ✓ Signal generation: the sender's neural or physiological state produces a measurable signal related to the target information.
- ✓ Transmission: the signal reaches the receiver at a measurable strength and with physical properties consistent with propagation through the environment.
- ✓ Reception: a defined biological mechanism can detect the signal at the relevant intensity and frequency.
- ✓ Information decoding: the receiver's response contains target-specific information, rather than only nonspecific changes in arousal.
- ✓ Experimental verification: manipulating the proposed signal changes receiver performance in a reproducible way.

A central challenge is whether a naturally generated brain field could reach another person at a sufficient signal-to-noise ratio to convey information. This must be established quantitatively rather than assumed.

Distance, orientation, background fields, and environmental conditions should be measured or controlled [9,10]. If receiver performance does not change as predicted when the relevant electromagnetic conditions are manipulated, the specific electromagnetic model would be weakened. An alternative mechanism should not be invoked automatically to rescue it.

- *Level 4: Quantum Physics as an Exploratory Possibility*

Quantum mechanics is foundational to modern physics and governs physical processes in biological matter. However, the existence of quantum processes in a biological system does not imply that the system can transmit information to another brain through entanglement [7].

A quantum-based GISH model would need to identify a specific physical substrate, define the proposed quantum state, explain how information becomes available to the receiver, and generate predictions that differ from conventional physical models. It would also need to demonstrate that the relevant quantum effects remain operationally meaningful under the conditions of the proposed experiment.

Without such evidence, quantum mechanics should remain an area for carefully defined theoretical investigation—not a general explanation for intuition, emotional connection, or alleged telepathy.

- *Level 5: Aura as an Operationally Defined Physical Signature*

The term aura is often used to describe a perceived field surrounding a person. GISH does not assume that such a field exists as a distinct entity carrying mental information. Instead, the term could be used provisionally for a measurable collection of physical signals, such as electrical, magnetic, optical, or thermal emissions. These variables must be measured separately because they have different physical properties and do not necessarily reflect the same biological processes [5,6].

A proposed aura-related signal would become relevant only if it reliably correlated with a defined sender state and predicted receiver responses under controlled conditions. Kirlian-style images cannot be treated as evidence of a mentalinformation field merely because they show a corona around an object [5].

➢ *Integrated Model*

The most parsimonious proposed sequence is: Sender's neural or bodily state → measurable output → potential transmission → receiver's biological response → objective test of information accuracy.

For conventional communication, the links in this sequence are supported by established mechanisms. For non-sensory communication, the transmission pathway, receiver mechanism, and reproducible information transfer remain unproven. GISH therefore does not require a universal energy field or a shared human consciousness. It first asks whether an objective effect exists. Only after independent replication should researchers attempt to determine whether electromagnetic, quantum, or another mechanism explains the result [1,8-10].

➢ *Conceptual Model: From Individual Brains to a Global Network*

The global aspect of GISH can be understood as a proposed hierarchy rather than a claim that humanity forms a single literal brain.

- Level A — Individual systems: Each person has distinct neural, cognitive, and physiological states.
- Level B — Established coupling: People influence one another through sensory, behavioural, social, and environmental pathways.
- Level C — Open empirical question: An information-specific effect may or may not persist under rigorous sensory isolation.
- Level D — Candidate physical mechanisms: If a reproducible effect exists, electromagnetic interaction or another defined physical pathway could be investigated.
- Level E — Exploratory interpretations: Quantum-mediated communication and an informational aura remain speculative possibilities requiring distinct evidence.

These levels are not equivalent in evidential strength. Evidence for ordinary social synchrony does not establish a global mind, and evidence of a sensory-isolation effect would not automatically establish an electromagnetic or quantum mechanism [1-4].

II. MATERIALS AND METHODS

➢ *Study Design*

A preregistered, double-blind, randomised sender–receiver experiment would provide an initial test of the central hypothesis. The sender would receive a randomly

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selected target, such as one of four standardised images representing predefined emotional categories. The receiver, isolated from the sender, would attempt to identify the target according to prespecified rules.

Target selection, trial timing, response recording, and scoring should be computer-controlled where feasible. Neither the receiver nor the person interacting with the receiver should know the correct target during the trial. The study protocol and statistical analysis plan should be registered before data collection.

➢ *Experimental Conditions*

- Ordinary interaction: Participants can communicate normally, providing a comparison for known interpersonal influence.
- Sensory isolation: Visual, auditory, electronic, behavioural, and experimenter-mediated information leakage is minimised and assessed.
- Distance variation: Prespecified distances are compared while relevant environmental and procedural variables are controlled.
- Electromagnetic measurement: Relevant fields are measured with appropriate instruments, and environmental noise and instrument limitations are documented.
- Electromagnetic manipulation: Where technically justified, validated shielding or another controlled intervention tests a specific prediction.
- Sham and target-control trials: Randomised trials allow analysis of expectancy effects, timing artefacts, and associations with incorrect or shuffled targets.

A distance effect should not be assumed in advance. Its expected direction and magnitude should be specified by the chosen physical model before testing.

➢ *Outcomes and Statistical Analysis*

The primary outcome should be objective target-identification accuracy or another prespecified measure of information transfer. Subjective impressions of emotional connection may be collected as secondary measures but should not substitute for target-specific accuracy.

Sample size should be determined through an a priori power calculation. The analysis should report effect sizes, confidence intervals, chance-level comparisons, and all prespecified exclusions. Multiple comparisons must be controlled, and null results should be reported. An independent laboratory should replicate any positive primary finding before it is interpreted as evidence for a new communication pathway [3,4].

➢ *Mechanism-Specific Testing*

If a non-sensory effect is replicated, the next stage should compare competing explanations. For an electromagnetic model, measured signals should predict receiver performance, and a validated manipulation of the proposed pathway should alter the effect in the predicted direction. For a quantum model, researchers would first need a detailed, operationally testable physical theory identifying the relevant quantum process and distinguishing its predictions from classical alternatives. For an aura-related model, researchers would need to define the measured physical components and demonstrate that these components provide reproducible information about the sender's state. No mechanism should be accepted solely because it is compatible with a positive result.

➢ *Ethical Considerations*

The study should receive appropriate institutional ethics approval and informed consent. Emotional stimuli should be nonharmful, participants should be free to withdraw, and physiological or neural data should be handled in accordance with applicable privacy and data-protection requirements.

➢ *Falsifiable Predictions*

Table 1 Falsifiable Predictions

Prediction	Result supporting the tested hypothesis	Result weakening the tested hypothesis
Information-specific accuracy	Independent replications show prespecified above-chance performance under sensory isolation.	Adequately powered studies consistently show chance-level performance.
Target specificity	Actual targets predict responses better than shuffled targets.	Incorrect or shuffled targets show similar associations.
Distance dependence	A preregistered physical model predicts a replicable distance relationship.	The predicted relationship is absent or inconsistent.
Electromagnetic mediation	Measured fields predict performance and validated manipulation changes the effect as predicted.	Field measurements and interventions have no reproducible relationship with performance.
Emotional-state identification	A predefined emotional category is identified above chance.	Only vague impressions or retrospective interpretations are reported.
Quantum mechanism	A specific quantum model produces distinctive, replicated predictions.	No operational quantum mechanism or distinguishing evidence can be demonstrated.
Aura-related signal	A predefined physical signature predicts sender-state information and receiver responses.	The proposed signature is unmeasurable, nonspecific, or unrelated to receiver performance.

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A negative result would weaken the specific model tested, rather than every conceivable form of interpersonal connection. Conversely, one positive study would not be sufficient to establish a new mechanism.

III. RESULTS

The reviewed literature identified three major areas relevant to the Global Inter-Brain State Hypothesis (GISH): established interpersonal brain-state coupling, disputed evidence concerning anomalous information transfer, and proposed physical mechanisms that remain insufficiently validated.

First, research on inter-brain coupling indicates that neural activity can become temporally associated between individuals during social interaction. However, such associations may arise from shared sensory inputs, coordinated behaviour, and common environmental stimuli. Therefore, inter-brain synchrony alone does not demonstrate direct communication between separate brains.

Second, studies investigating anomalous perception have reported mixed findings. Some analyses have described performance above chance under specific experimental conditions, whereas other analyses have highlighted replication difficulties and methodological limitations. Consequently, the reviewed evidence does not establish reliable, non-sensory information transfer between isolated individuals.

Third, electromagnetic fields are measurable physical phenomena, but the reviewed literature does not establish that naturally generated fields from one person's brain can transmit meaningful information to another person's brain under sensory-isolation conditions. Similarly, quantum entanglement does not independently establish a mechanism for controllable interpersonal communication. The concept of an aura carrying mental information also lacks sufficient evidence for acceptance as an established scientific phenomenon.

The review therefore supports a distinction between established interpersonal coupling and the hypothetical possibility of information transfer without recognised sensory communication. It identifies a need for preregistered, adequately powered experiments with rigorous sensory isolation, objective target identification, prespecified statistical analyses, and independent replication.

No original experimental data were collected for this manuscript. Accordingly, no experimental effect size, statistical significance, or confirmation of the GISH hypothesis can be reported. The findings should be interpreted as a qualitative synthesis of selected literature rather than empirical validation of the proposed hypothesis.

IV. DISCUSSION

GISH provides a framework for distinguishing established interpersonal coupling from the more speculative possibility of non-sensory information transfer. Its principal scientific contribution is not the assertion that humans already share one mind, but the formulation of a testable question with explicit conditions for support and rejection [1-4].

Electromagnetic physics provides a candidate pathway because neural fields can be measured and their physical properties quantified. Nevertheless, the existence of a field does not establish sufficient transmission strength, information content, or a suitable receiver mechanism for brain-tobrain communication [8-10].

Quantum physics offers a separate theoretical perspective, but entanglement alone does not permit controllable messaging. A quantum explanation would require an identifiable physical substrate and evidence that cannot be accounted for by conventional physical mechanisms [7].

The concept of aura can be retained only as an operationally defined construct. A measurable physical signature may be investigated, but a unified aura carrying emotions or thoughts should not be presumed to exist [5,6].

The proposition that humanity constitutes one entity may serve as a philosophical analogy for extensive social interdependence. It should not be presented as a demonstrated biological or physical fact. A scientific claim of global information connectivity would require a defined mechanism, reproducible observations, and evidence across independently conducted experiments.

This paper has important limitations. The anomalous-perception literature remains contested, interbrain synchrony is vulnerable to common-input confounding, and proposed electromagnetic, quantum, and aura related mechanisms have not established non-sensory mental communication. The present manuscript is therefore a hypothesis framework and research proposal, not a completed experimental study or a systematic review.

V. CONCLUSION

The Global Inter-Brain State Hypothesis proposes that human beings form a highly interconnected social and biological network, while asking whether an additional information-specific effect can be demonstrated under rigorous sensoryisolation conditions [1-4].

Established electromagnetic and quantum principles provide legitimate scientific foundations for studying physical processes, but neither currently establishes direct communication between isolated human brains. An aura carrying mental information is likewise unverified [7-10].

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The most credible research pathway is to establish whether a reproducible effect exists, determine its information content and boundary conditions, and then test candidate mechanisms against explicit alternatives. GISH will become scientifically useful only to the extent that its predictions are measurable, falsifiable, and independently reproducible.

➢ *Literature Identification and Review Approach*

This manuscript uses a selected narrative review of literature relevant to inter-brain coupling, anomalous perception, electromagnetic theories of neural function, quantum information, and a aura related claims. References were checked against available indexed records and publisher information for bibliographic consistency.

This was not a systematic review: no exhaustive database search, duplicate screening, formal eligibility assessment, or systematic risk-of-bias evaluation was completed. The selected references therefore should not be interpreted as a comprehensive assessment of all evidence relating to GISH. A formal systematic search would be required if the manuscript were to be submitted as a systematic or comprehensive review.

➢ *Ethics and Declarations*

- *Ethics Approval and Consent to Participate*

Ethics approval was not required for this manuscript because it is a conceptual hypothesis paper based on a narrative review of previously published literature. No human participants were recruited, no experiments were conducted, and no identifiable personal data were collected or analysed.

- *Consent for Publication*

Not applicable. This manuscript does not contain identifiable personal information, images, or videos of individual participants.

- *Availability of Data and Materials*

No new datasets were generated or analysed for this manuscript. The literature discussed is cited in the reference list.

- *Competing Interests*

The authors declares no competing interests.

- *Funding*

This research has not received any funding.

- *Authors' Contributions*

Sourav conceptualised the study, developed the central hypothesis and conceptual framework, conducted the literature review, formulated the research questions and falsifiable predictions, designed the proposed methodology, interpreted the literature, and prepared the original manuscript. Mandeep contributed to the literature review, critically evaluated relevant evidence, and assisted in refining the hypothesis. Kartikey contributed to the theoretical framework and interpretation of the proposed mechanisms. Anirudh assisted in reviewing the relevant literature and critically assessing the scientific rationale. Vinay contributed to the formulation of testable predictions and the proposed research methodology. Sameer critically revised the manuscript for important intellectual content and contributed to the discussion of limitations and future research directions. Navya reviewed and edited the manuscript and provided critical feedback on the overall conceptual framework. All authors reviewed and approved the final manuscript.

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