Conscious Under Anesthesia

What the Clinical Evidence Actually Shows

Project: Return to Consciousness
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Authorship Note: Co-authored with AI as a disciplined thinking instrument—not a replacement for judgment. Prioritizes epistemic integrity and truth-seeking as a moral responsibility.
Finalized: February 2026

Abstract

General anesthesia reliably produces three outcomes: the patient does not respond, does not remember, and does not complain afterward. These clinical successes are frequently misrepresented as proof that suppressing brain activity eliminates experience—and therefore that the brain produces consciousness. This inference is structurally invalid. What anesthesia demonstrably abolishes is behavioral output and memory consolidation, not experience itself. The clinical literature documents awareness persisting under anesthesia at rates that challenge the production narrative—through isolated forearm studies, dissociative anesthetics, and dreaming under sedation. If experience were generated by neural computation, substantial suppression should produce substantial reduction in experience; yet awareness persists at levels of suppression that production models struggle to explain without auxiliary hypotheses. Standard protocols explicitly include amnestic agents whose purpose is to erase recall of events that may nonetheless occur. This essay examines what the evidence actually shows—not to defend any particular metaphysics, but to correct a pervasive misrepresentation that has shaped public understanding of consciousness for decades.

Keywords: anesthesia awareness · consciousness · production model · isolated forearm technique · implicit memory · dreaming under anesthesia · neural suppression · brain-consciousness relationship

I. What Anesthesia Actually Does

General anesthesia is one of medicine's great achievements. It enables surgery that would otherwise be impossible. Patients emerge without distressing memories, without behavioral evidence of suffering, and overwhelmingly satisfied with their care.

But what, precisely, does anesthesia accomplish? The clinical goals are explicit:

1. **Hypnosis** — loss of awareness

2. **Amnesia** — no memory formation
3. **Analgesia** — no pain response
4. **Immobility** — no movement

Notice that three of these four goals concern *output*: what the patient does, remembers, and reports. Only "hypnosis" concerns subjective experience directly—and hypnosis is the one goal that cannot be directly verified.

The Operational Reality

In clinical practice, anesthetic adequacy is assessed through behavioral and physiological proxies:

- Does the patient move in response to surgical stimulation?
- Do heart rate and blood pressure suggest pain response?
- Does the patient remember anything afterward?

If the answers are no, no, and no, anesthesia is deemed successful. The patient is declared to have been "unconscious."

But this is a declaration about behavior and memory, not a verified claim about experience. The distinction is not pedantic. A patient who experiences surgery but cannot move (due to paralytic agents) and cannot remember (due to amnestic agents) will satisfy all clinical criteria for successful anesthesia—regardless of what they experienced.

The Amnestic Component

Standard anesthetic protocols routinely include benzodiazepines, particularly midazolam, as premedication. Midazolam is dose-dependently sedating and does reduce subjective experience at higher doses, but its distinctive pharmacological contribution at premedication doses is suppression of memory formation—selectively impairing explicit memory by disrupting hippocampal consolidation, preventing experiences from being encoded into retrievable form.

The clinical rationale is explicit: patients should not form distressing memories of the perioperative period. This goal makes sense, and part of the justification is redundant safety margins—ensuring amnesia even during transitional phases (induction, emergence) when awareness is most likely. But the routine inclusion of dedicated amnestic agents is at minimum compatible with the recognition that experience may occur in states that primary anesthetics do not reliably prevent.

II. The Evidence of Persistent Consciousness

The claim that clinically adequate anesthesia eliminates consciousness is not merely philosophically questionable—it is strongly challenged by the anesthesia literature itself.

Isolated Forearm Studies

The isolated forearm technique (IFT), developed by Tunstall in the 1970s, provides direct evidence of consciousness during anesthesia that bypasses the problem of post-operative recall.

The method is simple: before administering neuromuscular blocking agents, a tourniquet is inflated on one forearm, preventing the paralytic from reaching the hand. During surgery, patients are periodically asked to squeeze the investigator's hand if they can hear.

The results are striking:

- **IFT studies consistently find responsive awareness in a substantial fraction of patients** under standard anesthetic regimens—rates vary across protocols and surgical phases, but even conservative estimates place the figure in the range of 5–15%
- The vast majority of IFT-positive patients have no subsequent memory of responding—they were aware but amnestic

These findings are remarkable. These patients satisfied all standard criteria for adequate anesthesia. They did not move spontaneously, showed no physiological signs of distress, and reported no awareness post-operatively. By every conventional measure, they were "unconscious." But when given a channel to communicate, they demonstrated that they could hear, understand, and respond to commands.

Not all researchers agree that IFT-positive responses necessarily reflect full phenomenal consciousness—they may represent degraded or dissociated processing rather than rich subjective experience. But even on the most conservative interpretation, these responses demonstrate that clinically "adequate" anesthesia does not eliminate cognitive processing sufficient for language comprehension and volitional motor response. That alone undermines the equation of behavioral silence with absent experience.

Dreaming Under Anesthesia

Anesthetic dreaming provides further evidence of persistent subjective experience:

- Reported dream incidence ranges from 3% to over 50%, depending on anesthetic agent and assessment method
- Propofol anesthesia produces dream reports in up to 60% of patients in some studies
- Dream reports occur even when anesthetic protocols maintain stable surgical depth throughout, suggesting dreams are not confined to emergence
- Dream phenomenology resembles normal sleep dreams, suggesting genuine experience rather than confabulation

A reasonable objection is that many anesthetic dreams may arise during lighter phases—induction or emergence—rather than at surgical depth. This cannot be fully excluded, and the wide range of reported incidence likely reflects methodological differences in timing and assessment. But even granting this qualification, dreaming under anesthesia demonstrates that behavioral unresponsiveness can coexist with subjective experience—which is precisely the dissociation the production narrative denies.

Anesthesia Awareness with Recall

The most dramatic evidence comes from patients who remember:

- Anesthesia awareness (conscious experience with subsequent recall) occurs in approximately 1-2 per 1000 anesthetics
- Patients describe specific, verifiable surgical details: conversations, personnel, events in correct sequence

- Awareness is associated with substantially elevated risk of post-traumatic stress disorder, with some studies reporting rates above 50%
- In these cases, all standard monitoring indicated adequate anesthesia

Awareness cases are framed as "failures" of anesthesia. But what they reveal is that the standard markers of unconsciousness—behavioral silence, physiological stability, reassuring monitor values—do not reliably indicate absence of experience. The patient is conscious and forming memories but cannot move or signal. If monitoring cannot detect consciousness when it is present and memorable, why would we trust it to detect absence of consciousness?

The Ketamine Paradox

Ketamine poses a direct challenge to the "anesthesia eliminates consciousness" narrative.

Ketamine is a clinically approved anesthetic, used routinely in emergency and pediatric settings. By operational criteria—unresponsiveness to pain, amnesia for the procedure—ketamine works.

But ketamine does not abolish consciousness. It produces some of the most vivid experiences in all of psychopharmacology:

- Dissociation from the body
- Profound alterations in space and time perception
- Encounters with other beings or presences
- Mystical-type experiences rated among the most meaningful of subjects' lives
- Phenomenology with striking structural similarities to near-death experiences, including disembodiment, encounters with presences, and transcendence of ordinary space and time

The patient under ketamine anesthesia appears "unconscious" by behavioral standards. But subjectively, they may be having the most intense experience of their lives.

This is not a peripheral case. Ketamine breaks the definitional link between anesthesia and unconsciousness. If ketamine counts as anesthesia—and clinically, it does—then "anesthesia" cannot mean "elimination of experience." It can only mean elimination of responsiveness and accessible memory. The very concept of anesthesia, once examined, does not support the inference it is claimed to prove.

III. The Neural Activity Paradox

The claim that anesthesia "shuts down consciousness" depends entirely on what "consciousness" means in that sentence. In anesthesia research, "unconscious" is defined operationally as: no behavioral response, no subsequent recall. These are measurable outcomes. Consciousness—subjective experience—is not measured at all.

This terminological decision carries enormous weight in the production argument. When researchers report that suppressing brain activity "eliminates consciousness," they mean it eliminates behavioral response and memory formation. Those are genuinely different claims. The neurophysiological data reveal exactly how different.

What Anesthetics Do to the Brain

General anesthetics substantially suppress measurable brain activity:

- **Decreased connectivity:** Propofol significantly reduces corticocortical and thalamocortical connectivity, particularly long-range connections between association regions
- **Decreased complexity:** The complexity and uniqueness of brain functional dynamics decline substantially under anesthesia
- **Altered oscillations:** Alpha and delta activity increase while beta activity decreases; at deeper levels, slow oscillations (~1 Hz) dominate
- **Burst suppression:** At surgical depths, the EEG can show burst suppression—alternating periods of activity and near-isoelectric flatline, representing profound neural inactivation

This suppression is real and measurable. If suppressing neural activity is supposed to eliminate consciousness, this is the mechanism doing it.

What the Neural Data Actually Show

Here is what should give any honest observer pause: **consciousness persists despite this suppression.**

The IFT studies that find responsive awareness in a substantial fraction of patients—ranging from single digits in some protocols to over a third in others—are conducted at standard anesthetic depths. These are depths at which brain activity is substantially suppressed, connectivity is reduced, and neural complexity has declined. Yet when patients are given a channel to respond, they demonstrate that they can hear and follow commands.

This directly exposes the terminological confusion. The claim was: *we suppressed neural activity, and the patient became unconscious.* The IFT data show: *we suppressed neural activity, and the patient lost spontaneous behavioral output. Consciousness remained.* The word "unconscious" was covering a behavioral measurement and presenting it as a finding about experience—using the same mechanism (neural suppression) that was supposed to be shutting down consciousness as evidence that consciousness was gone.

The Ketamine Inversion

Ketamine makes the terminology untenable from the opposite direction. Unlike propofol and volatile anesthetics, ketamine does not globally suppress brain activity. It produces a distinctive neurophysiological signature:

- **Increased gamma oscillations** in prefrontal cortex and hippocampus
- **Altered but not suppressed** overall activity patterns
- **Dissociation of brain networks** rather than global suppression

And ketamine produces not diminished consciousness but *intensified* phenomenology—vivid, structured, often overwhelming experiences that patients rate among the most significant of their lives.

If "anesthesia = unconsciousness = eliminated experience," ketamine is a logical impossibility. It achieves anesthesia (behavioral silence) not by suppressing neural activity but by altering it—and it does not eliminate experience. It frequently intensifies it. The patient is "unconscious" by the standard definition while potentially having the most vivid experience of their life.

The production model faces a dilemma it cannot resolve cleanly:

- Standard anesthetics suppress activity but consciousness persists (IFT data)
- Ketamine alters but doesn't suppress activity and consciousness intensifies

Neither pattern fits "reduce activity → reduce consciousness."

What the Sophisticated Theories Say

Leading production frameworks—Global Workspace Theory and Integrated Information Theory—each have targeted responses to these findings. GWT can argue that residual global ignition persists even under suppression; IIT can posit that ketamine fragments the brain into isolated islands of high integrated information. Neither theory is refuted by the data. But both must invoke auxiliary hypotheses specifically to explain why the evidence runs in the opposite direction from their default predictions. The question is not whether production models can survive the anesthesia evidence, but whether the evidence supports the confidence with which "anesthesia proves production" is asserted. It does not—and the neural data are the clearest reason why.

IV. The Structure of the Misrepresentation

Given this evidence, how has the narrative that "anesthesia proves consciousness is produced by the brain" achieved such currency?

The Inference Pattern

The misrepresentation follows a consistent structure:

1. Suppress brain activity with anesthetic drugs
2. Observe that the patient produces no behavioral output
3. Observe that the patient reports no memory afterward
4. Conclude that consciousness was absent
5. Conclude that the brain must produce consciousness (since suppressing it eliminated consciousness)

The error occurs at step 4. Absence of output and absence of memory do not establish absence of experience—especially when the protocol is specifically designed to eliminate output and memory.

The Circularity

The reasoning is circular in a way that should be immediately apparent:

- We want to know whether consciousness persists under anesthesia
- Our only access to consciousness is through behavior and report
- We pharmacologically abolish behavior and report
- We then interpret the resulting silence as evidence that consciousness is absent

This is like asking whether a radio station is still broadcasting after you've destroyed the radio. The silence tells you about the receiver, not the transmission.

What Would Falsify the Claim?

Consider what evidence could possibly contradict the "anesthesia eliminates consciousness" narrative:

- **Patient movement during surgery?** Attributed to inadequate anesthesia; increase the dose
- **Physiological signs of distress?** Attributed to reflex responses; not taken as evidence of experience
- **Post-operative awareness reports?** Classified as "anesthetic failure"—the exception that proves the rule
- **IFT responses showing consciousness?** Largely ignored in popular accounts; technical literature only
- **Ketamine phenomenology?** Treated as an anomaly, not as evidence about anesthesia in general

The narrative is structured to be unfalsifiable. Any evidence of persistent consciousness is classified as failure, anomaly, or exception—never as data that might revise the central claim.

A fair objection: the same structural concern applies to constraint or filter models. If consciousness is said to persist but be "filtered" from access, then any absence of evidence can be attributed to the filter, and any presence to residual transmission. The point here is not that one framework is falsifiable and the other is not—both face this challenge. The point is that the popular narrative presents the question as settled, when the evidence does not settle it for either side.

V. The Dissociation of Consciousness, Report, and Memory

The deeper problem is the routine conflation of three separable phenomena.

Three Distinct Variables

Consciousness — subjective experience; there is "something it is like" to be the subject

Responsiveness — behavioral output; the subject can signal or act on experience

Memory — subsequent accessibility; the subject can later recall the experience

These variables dissociate. A person can be:

- Conscious, responsive, and forming memories (normal waking state)
- Conscious and responsive but not forming memories (some drug states, infantile experience)
- Conscious but neither responsive nor forming memories (locked-in syndrome, awareness under paralysis)
- Responsive without consciousness (sleepwalking, some seizure states)

The combination that anesthesia research has documented extensively is: **conscious, unresponsive, amnestic**. The IFT literature shows patients who are aware and can respond when given a channel, but who form no memory. The ketamine literature shows patients with vivid experience but no behavioral connection to the environment.

Why the Conflation Persists

The conflation of consciousness with report serves several functions:

Methodological convenience. Science requires observable data. If consciousness can only be studied through report, then report becomes the operational definition of consciousness.

The philosophical distinction between experience and report is bracketed as "not scientifically tractable."

Clinical adequacy. From a medical standpoint, what matters is patient welfare. If patients don't suffer, don't remember, and don't complain, the clinical goal is achieved. Whether they "really" experienced something becomes a question without practical consequence.

Metaphysical commitment. If consciousness is produced by neural computation, then suppressing the computation should eliminate the product. The absence of report confirms the prediction. Evidence that consciousness persists would be theoretically inconvenient—better to classify it as failure or anomaly.

These motivations are understandable. But they do not justify representing a clinical success (absent report) as a metaphysical proof (absent experience).

VI. What the Evidence Actually Constrains

Having cleared away the misrepresentation, we can ask what anesthesia legitimately shows about consciousness.

What Is Established

1. Dependence. Normal conscious access to the environment depends on specific neural processes. Disrupt those processes, and access is disrupted. This is unsurprising and is predicted by any theory that takes the brain-consciousness relationship seriously.

2. Pharmacological dissociability. Different aspects of the conscious state—environmental connection, memory formation, pain perception, phenomenal experience—can be modulated somewhat independently. Ketamine disconnects environmental access while preserving or enhancing phenomenology. Midazolam blocks memory without necessarily blocking experience. This dissociability is informative about the structure of consciousness.

3. The inadequacy of behavioral proxies. Behavioral unresponsiveness does not reliably indicate absence of consciousness. This is the direct finding of IFT studies and is confirmed by awareness cases with recall. Any science of consciousness that relies solely on report is operating with a systematically biased instrument.

What Is Not Established

1. That suppressed neural activity eliminates experience. The evidence shows that suppressed activity eliminates *detectable* experience—which is a different claim. When detection methods are improved (IFT), consciousness is found at rates incompatible with the elimination hypothesis.

2. That the brain produces consciousness. Even if anesthesia eliminated experience (which the evidence does not support), this would show only that experience depends on brain activity—not that the brain generates experience. A radio that falls silent when damaged does not thereby prove that it generates the signal.

3. That current monitoring detects consciousness. BIS monitors, clinical signs, and standard assessment all fail to detect responsive awareness in IFT-positive patients, and fail to predict

which patients will later report awareness with recall. The monitoring measures neural and physiological variables—but these do not reliably track presence or absence of experience.

VII. Production vs. Constraint Under Anesthesia

The anesthesia evidence is compatible with both physicalist production models and consciousness-first constraint models. But the two frameworks interpret the data differently.

The Production Interpretation

The brain generates consciousness through neural computation. Anesthetics disrupt these computations, thereby disrupting the consciousness they generate. Ketamine's unusual receptor profile generates unusual experiences. Awareness cases represent incomplete suppression—the computation wasn't fully stopped.

On this view, the IFT data are troubling. If a substantial fraction of patients—even at the conservative end of the range—are consciously responsive under "adequate" anesthesia, then "adequate" doesn't mean what clinicians thought it meant. The production model predicts that sufficient suppression should eliminate consciousness—yet IFT finds it present far more often than the model expects.

The Constraint Interpretation

The brain constrains and filters consciousness rather than generating it. Anesthetics alter these constraints, changing what aspects of consciousness can manifest and what can be subsequently encoded. Ketamine loosens specific constraints, permitting dissociative and expansive phenomenology. The brain's normal filtering narrows the field of experience to what is useful for survival; anesthetics (especially dissociatives) can paradoxically expand it.

Ketamine's clinical success takes on a different meaning under this interpretation: analgesia achieved not by eliminating the experiencer but by decoupling conscious experience from bodily sensation—the experiential subject persists, often vividly aware, but no longer receives signals from the surgical field. The known mechanism (NMDA receptor antagonism disrupting thalamocortical communication) describes *what* is disrupted; the constraint interpretation offers an account of *why* this produces anesthesia without eliminating experience: the channel between body and experiencer is interrupted, not the experiencer itself.

On this view, the IFT data, awareness cases, and ketamine phenomenology all fit a coherent pattern: anesthesia alters specific constraints (on motor output, memory consolidation, sensory reception) while leaving the experiencer intact. Weakening constraints does not eliminate consciousness—it changes its character. The finding that consciousness persists despite profound neural suppression is compatible with the brain as filter; it is awkward for the brain as generator.

What Anesthesia Cannot Decide

Neither interpretation is refuted by the anesthesia data. The constraint model accommodates the findings with less friction—persistent awareness is coherent with a filter that has been disrupted, whereas it is awkward for a generator that has been suppressed.

The production model can accommodate the evidence through auxiliary hypotheses: the suppression wasn't complete enough, residual activity sustained minimal awareness, the measurements missed the relevant generators. These accommodations are not necessarily ad hoc—they may be correct. But they do represent a theory explaining away outcomes that run contrary to its most natural predictions.

Both frameworks face the same structural challenge: the ability to accommodate any result through flexible interpretation. The point is not that one model is falsifiable and the other is not. The point is that anesthesia does not decide between them—and certainly does not prove production models correct, despite the confidence with which this is asserted in popular accounts.

VIII. The Responsibility of Accurate Representation

The misrepresentation of anesthesia as proof of production is not a minor scholarly disagreement. It shapes how millions of people understand consciousness, death, and the nature of mind.

The Public Understanding

When neuroscientists write popular books claiming that anesthesia proves consciousness is generated by the brain, they are not reporting scientific consensus. They are asserting a philosophical interpretation that the clinical evidence does not support—and in important ways challenges.

The reader who encounters this claim comes away with the impression that science has settled the question. Consciousness is obviously produced by the brain; anesthesia proves it; anyone who questions this is indulging pre-scientific mysticism.

But the reader has been misled. The evidence shows that anesthesia abolishes report and memory—which is important, which is clinically valuable, which is a genuine achievement. The evidence does not show that anesthesia abolishes experience. The evidence suggests, if anything, that experience persists far more robustly than the production narrative predicts.

The Responsibility of Honesty

Intellectual honesty requires representing evidence accurately, even when accurate representation complicates preferred narratives. The claim that anesthesia proves production is not a simplification; it is a misrepresentation. The two are different.

A simplification says: "The details are complex, but the basic picture is X."

A misrepresentation says: "The basic picture is X"—when the details actually contradict X.

The anesthesia-proves-production claim is the latter. The details—IFT studies, ketamine phenomenology, awareness literature, the very inclusion of amnestic agents in protocols—do not merely complicate the production narrative. They challenge its core prediction that sufficient neural suppression eliminates experience.

Conclusion: What Remains Unknown

This essay does not argue that consciousness always persists under anesthesia. The question is not settled—and that is precisely the point.

What the evidence establishes is narrower and more secure: **the claim that anesthesia proves the brain produces consciousness is not supported by the evidence and is challenged by substantial clinical findings.**

The IFT literature, the ketamine paradox, the dreaming data, the awareness cases, the explicit use of amnestic agents—all point to the same conclusion: anesthesia reliably abolishes responsiveness and memory, not demonstrably experience.

This matters because the misrepresentation has shaped discourse for decades. It has contributed to a false sense that the mind-brain question is settled, that consciousness-first approaches are pre-scientific holdovers, that anyone who questions production models is ignoring what "science has shown."

Science has shown that we can render patients unresponsive and amnestic with remarkable reliability. Science has not shown that we thereby eliminate their experience. The difference between these claims is the difference between clinical success and metaphysical proof—a difference that intellectual honesty requires us to maintain.

What happens to consciousness under anesthesia remains one of the most important open questions in the science of mind. Pretending it has been answered serves no one.

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