Consciousness, Addiction, and Surgical Pain

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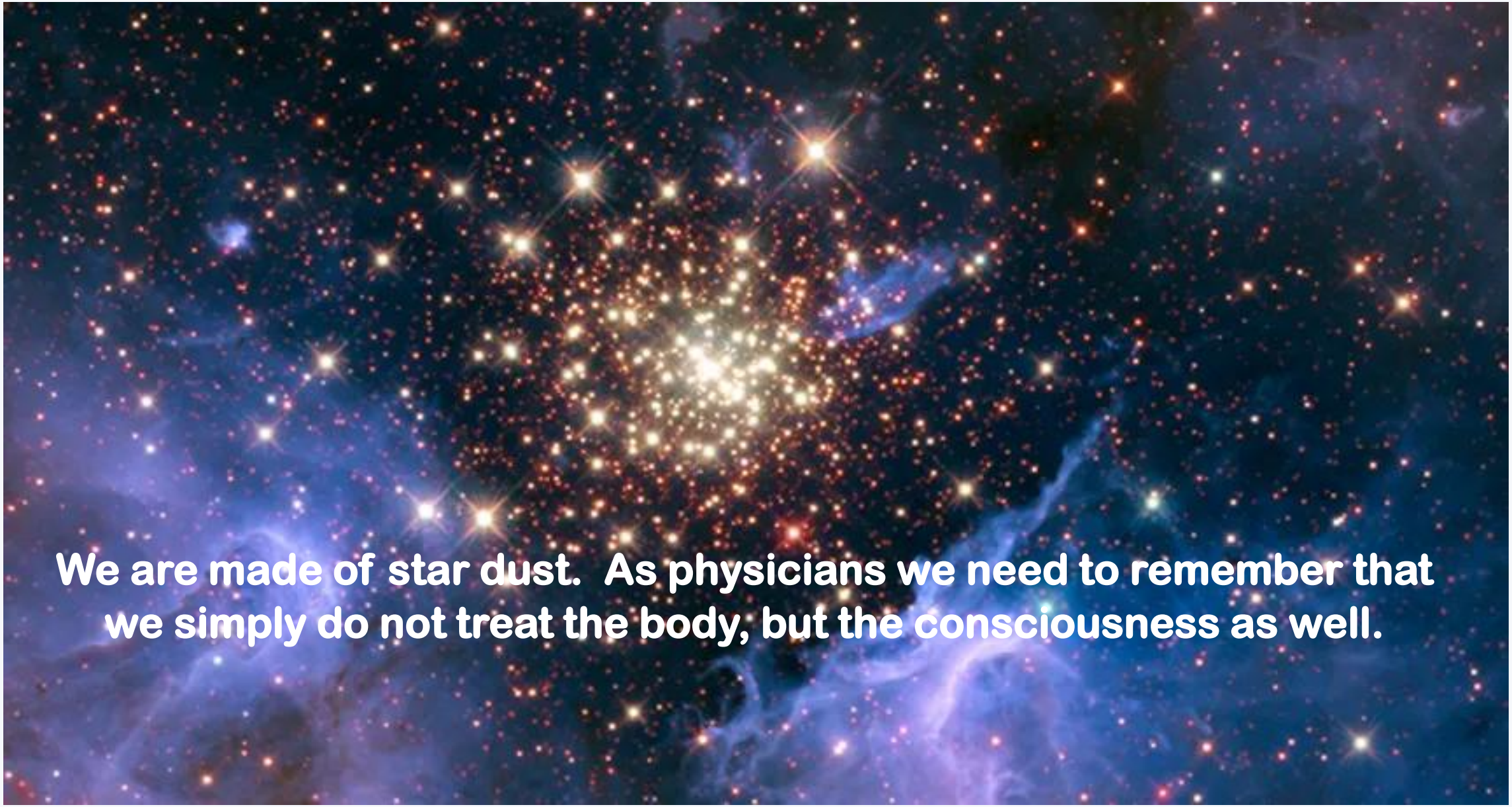
Objectives

1) Articulate the 2 leading models of consciousness and understand the basics of the Neural Correlate of Consciousness, gamma synchrony and default mode netowrk.

2) Understand the recommendations for patients on MOUD who present for surgery.

3) Describe several strategies for patients undergoing anesthesia who may have chronic pain or addiction


We are made of star dust. As physicians we need to remember that we simply do not treat the body, but the consciousness as well.

- Consciousness:
  - The state of being aware, or perceiving physical facts or mental concepts
  - a state of general wakefulness and responsiveness to environment;

Close your eyes and humor me for 1 minute. Please. This is the why!

The **hard problem** is the question of why and how physical processes in the brain give rise to **subjective experience**.

Science can study the “easy problems” of consciousness: how the brain processes vision, makes decisions, forms memories, responds to pain, or controls behavior.

But the hard problem asks something deeper: why does any of that processing feel like something from the inside?

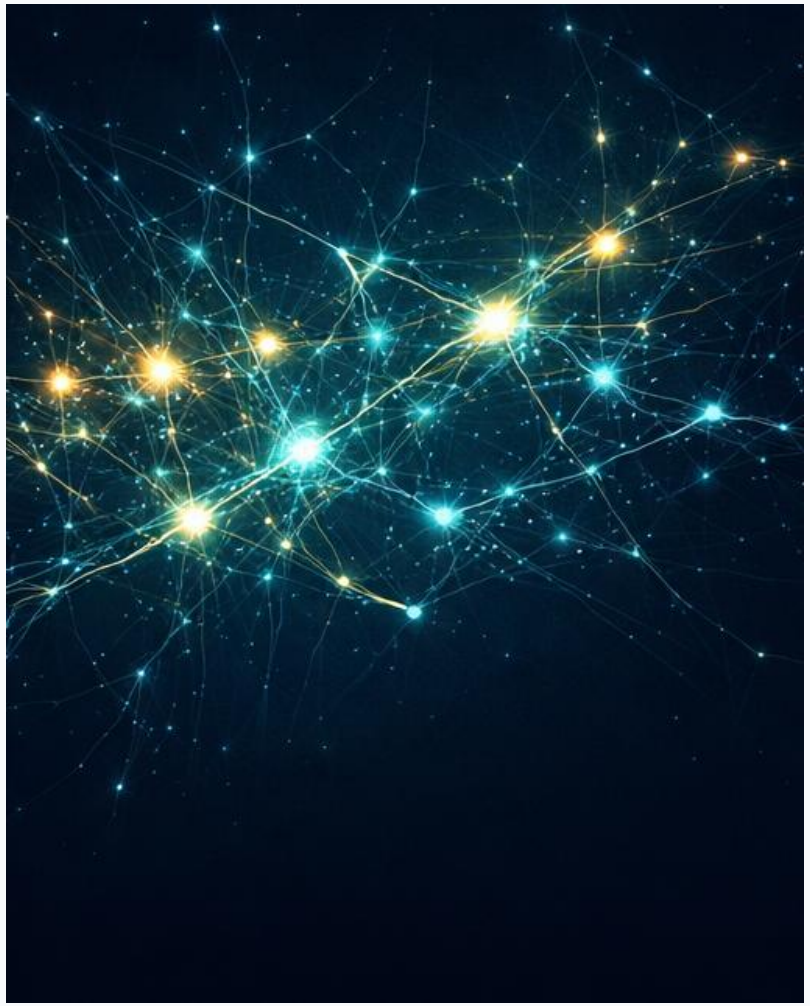
For example, we can describe what happens in the brain when someone sees the color red, but the hard problem asks why there is an inner experience of **redness** at all. Why is there a private, lived feeling rather than only electrical signals, chemicals, and behavior?

Consciousness in clinically useful terms

- Awareness
- Perception
- Salience
- Affect
- Memory
- Self-interpretation

For this lecture, consciousness means the lived, integrated experience of sensation, attention, emotion, memory, and meaning; not a detached philosophy problem.

Anesthesia does not simply suppress movement; it alters the conditions under which experience becomes possible.



CONSCIOUSNESS

Why Physicians should care about consciousness: This makes no sense to me.

- Awareness vs unawareness
- Memory vs amnesia
- Arousal vs disconnectedness

- Analgesia vs suffering
- Movement suppression vs meaningful comfort
- Addiction to disrupt consciousness and disturbing emotions.

Clinical translation: when we manage anesthesia, we are already managing perception, distress, memory, and meaning, not just autonomic responses. When managing addiction, we are attempting to repair the brain so that these processes can flourish

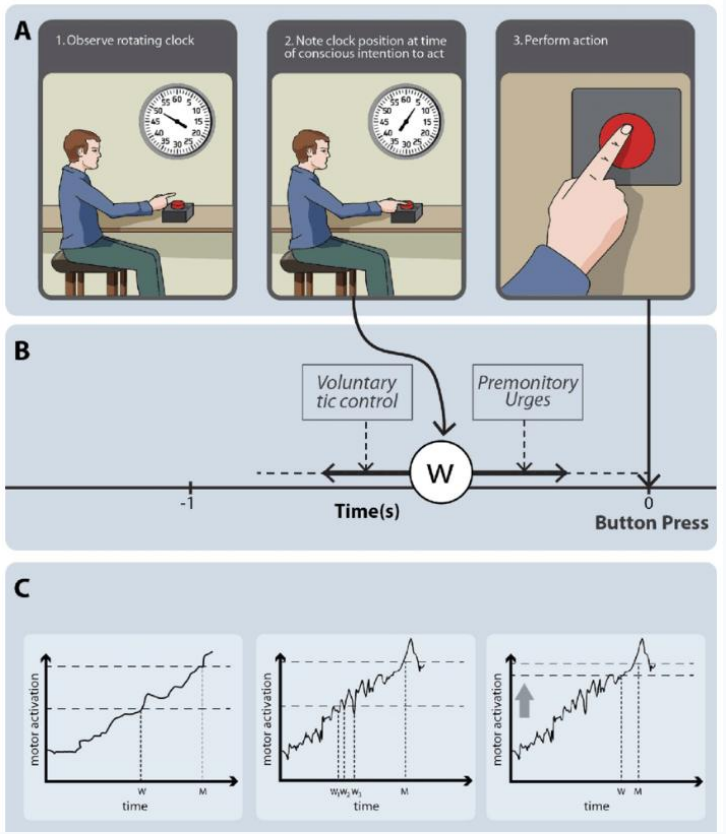
Time of conscious intention to act in relation to onset of cerebral activity (readiness-potential). The unconscious initiation of a freely voluntary act

Brain. 1983 Sep:106 (Pt 3):623-42. doi: 10.1093/brain/106.3.623

Libet found that measurable brain activity, called the readiness potential, began several hundred milliseconds before participants reported consciously deciding to act.

Unconscious brain processes may begin an action before conscious awareness

Consciousness may still have a “veto” power over whether the action is carried out.

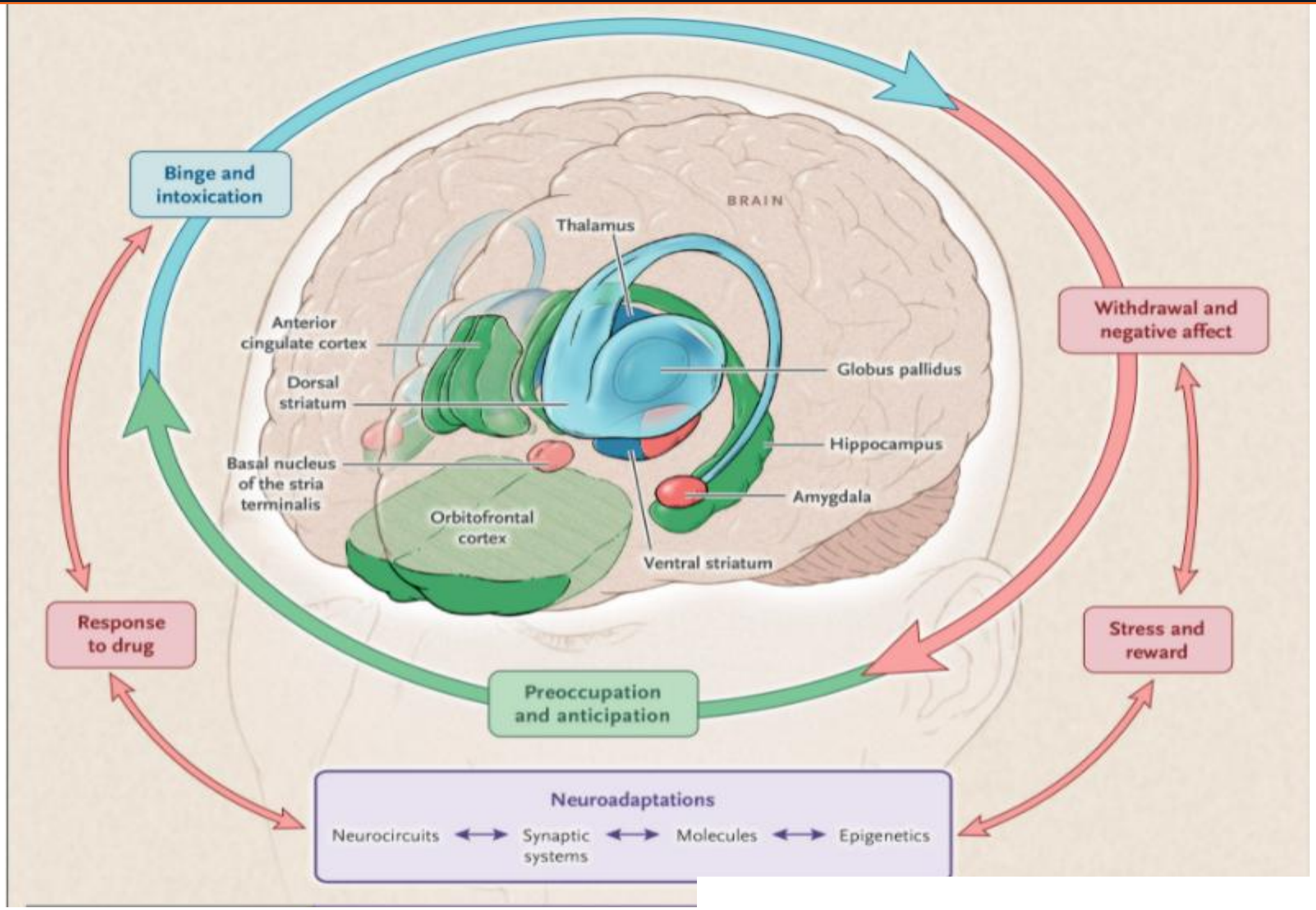


https://www.researchgate.net/figure/A-Figurative-representation-of-the-Libet-clock-task-Participants-view-a-rotating-clock_fig1_323574143

Two Leading Theories of Consciousness

Global Neuronal Workspace Theory (GNWT)

Integrated Information Theory (IIT)



N ENGL J MED 374;4 NEJM.ORG JANUARY 28, 2016

Global Neuronal Workspace Theory (GNWT)

Consciousness is an access mechanism. Information becomes conscious when it is broadcast widely to many different brain regions (a "global workspace").

Key Brain Areas: Emphasizes long-range connectivity, especially involving the prefrontal cortex (PFC) and parietal regions, as the "broadcaster" hubs.

Prediction: Conscious events are accompanied by sudden, transient "ignition" events and widespread, long-range neural synchrony across the brain.

Explains: Focuses on the function and access of information (access consciousness), and how information is used for planning and decision-making.

Global Neuronal Workspace Theory (GNWT)

The “gate” is not one anatomical structure. It is a functional bottleneck.

Many signals compete for access: Pain, Fear, Craving a drug, surgical stimulus, Auditory input, Memory, Threat detection

Integrated Information Theory (IIT)

Consciousness is a fundamental property of a system that can integrate a large amount of information in an irreducible way.

A complex, interconnected network where the unique pattern of relationships defines the experience (qualia).

Key Brain Areas: Predicts that the capacity for consciousness lies within the **"posterior cortical hot zone"** (back of the brain; e.g., visual and temporal cortices), which maintains sustained, local interaction.

Prediction: Consciousness correlates with sustained activity within posterior regions for the duration of a conscious experience, with strong local connectivity.

Explains: Focuses on the quality and quantity of subjective experience (phenomenal consciousness),

IIT often emphasizes a posterior cortical "hot zone," involving areas such as:

Occipital cortex
Temporal cortex
Parietal cortex
Posterior cingulate/precuneus regions

IIT says consciousness is not just broadcasting.

Consciousness **is** the intrinsic integrated structure of the system.

Low Phi versus High Phi

System A — Separate Parts
Suppose you have:
•many independent processors
•each doing its own thing
•with little interaction
There may be a LOT of information.
But the system is fragmented.
This system would have: $\Phi \approx 0$
because the whole is basically reducible to separate components.

System B — Highly Integrated
Now imagine:
•all components constantly interacting
•influencing each other
•creating unified internal states
The system becomes:
•interconnected
•irreducible
•causally unified
This system would have: $\Phi > 0$
and potentially much larger Φ.

Φ represents how much the whole system knows or experiences that none of the isolated parts could possess independently.

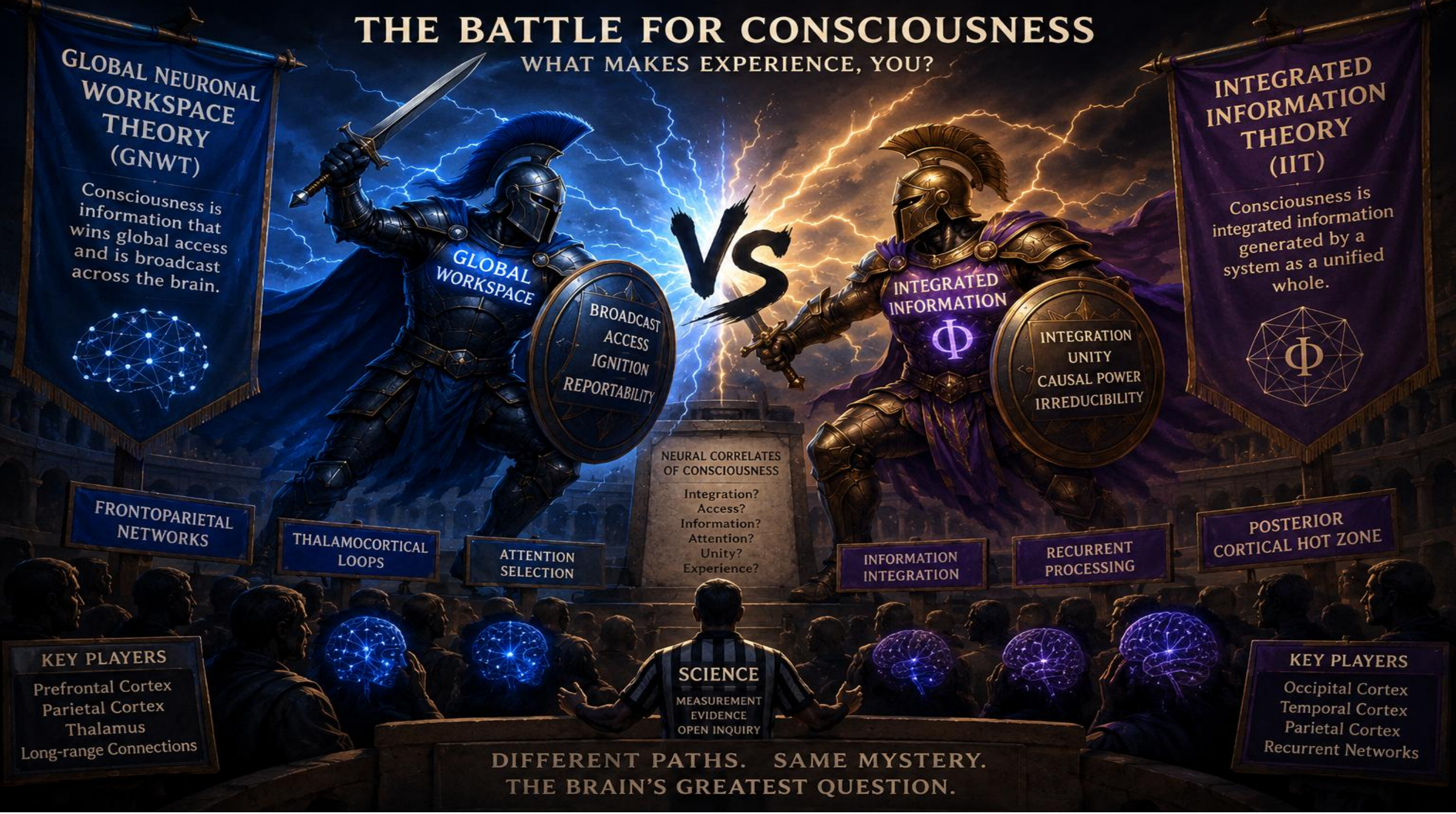
Question	Gate / Global Workspace	Integrated Information
Main idea	Consciousness occurs when information is globally broadcast	Consciousness occurs when information is integrated into an irreducible whole
Main metaphor	Theater, spotlight, broadcast, access gate	Unified causal web
Emphasis	Access, reportability, attention, cognition	Experience itself, unity, intrinsic structure
Brain regions	Frontoparietal, thalamocortical, long-range networks	Posterior cortical hot zone, recurrent integrated networks
Anesthesia effect	Blocks global broadcasting/access	Reduces integration/complexity
Pain implication	Pain becomes conscious when nociception gains global access	Pain is conscious when bodily, sensory, affective information is integrated into experience
Weakness	May explain report/access more than raw experience	Difficult to measure and controversial in its broader claims

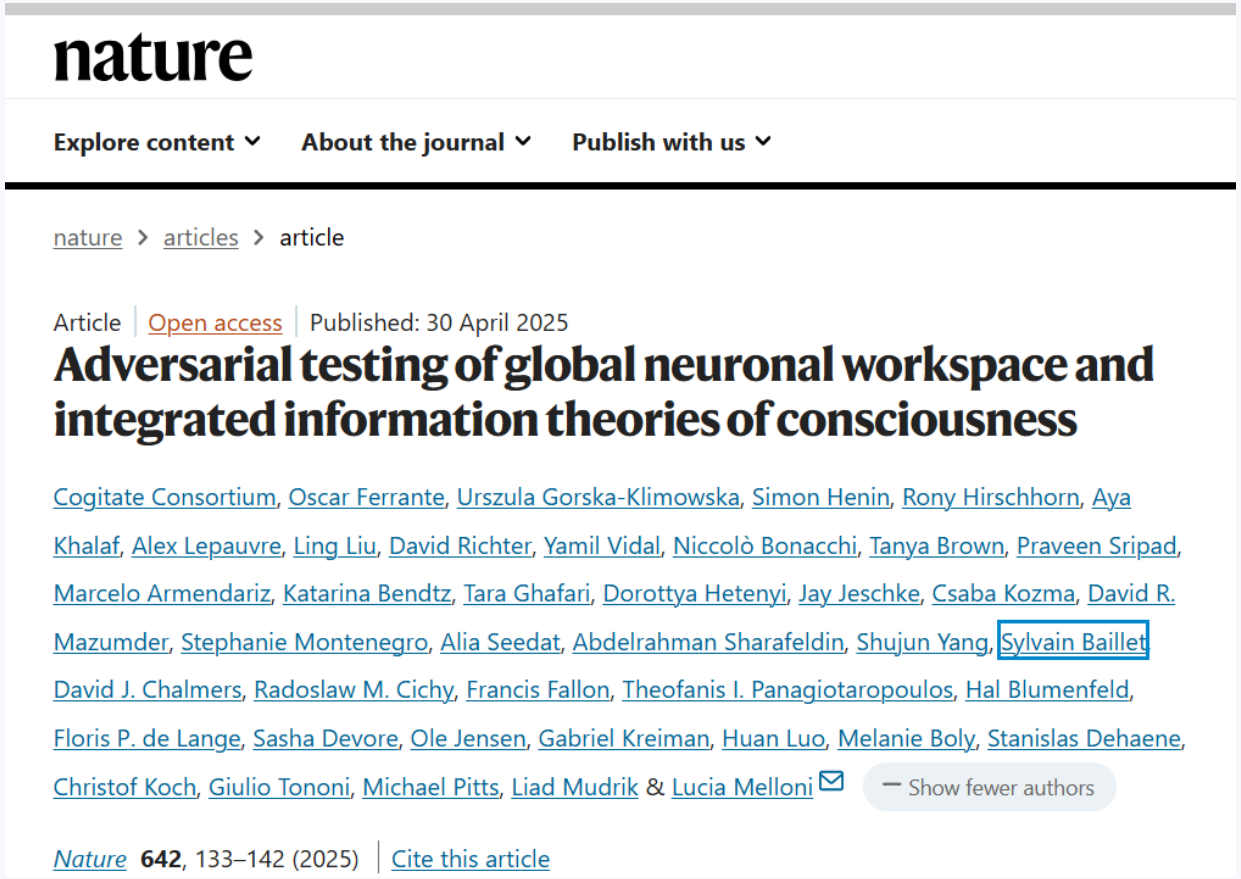
Neural Correlate of Consciousness

NCC, is the minimal neural mechanisms sufficient for a conscious experience. The two models disagree about where and when the NCC occurs.

NCC debate is no longer “is the brain active or inactive?” The real question is whether consciousness depends more on global access or integrated experience .

Regions and receptors


THE BATTLE FOR CONSCIOUSNESS
WHAT MAKES EXPERIENCE, YOU?
GLOBAL NEURONAL WORKSPACE THEORY (GNWT)
Consciousness is information that wins global access and is broadcast across the brain.
GLOBAL WORKSPACE
BROADCAST
ACCESS
IGNITION
REPORTABILITY
VS
INTEGRATED INFORMATION Φ
INTEGRATION
UNITY
CAUSAL POWER
IRREDUCIBILITY
INTEGRATED INFORMATION THEORY (IIT)
Consciousness is integrated information generated by a system as a unified whole.
NEURAL CORRELATES OF CONSCIOUSNESS
Integration?
Access?
Information?
Attention?
Unity?
Experience?
FRONTOPARIETAL NETWORKS
THALAMOCORTICAL LOOPS
ATTENTION SELECTION
INFORMATION INTEGRATION
RECURRENT PROCESSING
POSTERIOR CORTICAL HOT ZONE
KEY PLAYERS
Prefrontal Cortex
Parietal Cortex
Thalamus
Long-range Connections
SCIENCE
MEASUREMENT
EVIDENCE
OPEN INQUIRY
KEY PLAYERS
Occipital Cortex
Temporal Cortex
Parietal Cortex
Recurrent Networks
DIFFERENT PATHS. SAME MYSTERY.
THE BRAIN'S GREATEST QUESTION.



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Article | Open access | Published: 30 April 2025

Adversarial testing of global neuronal workspace and integrated information theories of consciousness

Cogitate Consortium, Oscar Ferrante, Urszula Gorska-Klimowska, Simon Henin, Rony Hirschhorn, Aya Khalaf, Alex Lepauvre, Ling Liu, David Richter, Yamil Vidal, Niccolò Bonacchi, Tanya Brown, Praveen Sripad, Marcelo Armendariz, Katarina Bendtz, Tara Ghafari, Dorottya Hetenyi, Jay Jeschke, Csaba Kozma, David R. Mazumder, Stephanie Montenegro, Alia Seedat, Abdelrahman Sharafeldin, Shujun Yang, Sylvain Baillet, David J. Chalmers, Radoslaw M. Cichy, Francis Fallon, Theofanis I. Panagiotaropoulos, Hal Blumenfeld, Floris P. de Lange, Sasha Devore, Ole Jensen, Gabriel Kreiman, Huan Luo, Melanie Boly, Stanislas Dehaene, Christof Koch, Giulio Tononi, Michael Pitts, Liad Mudrik & Lucia Melloni ✉ — Show fewer authors

Nature **642**, 133–142 (2025) | Cite this article

7 years and studied 256 human participants using: fMRI, MEG, and EEG

Cogitate Consortium., Ferrante, O., Gorska-Klimowska, U. et al. Adversarial testing of global neuronal workspace and integrated information theories of consciousness. Nature 642, 133–142 (2025). https://doi.org/10.1038/s41586-025-08888-1

Mixed Results: Neither theory was definitively proven correct; the data challenged central claims of both.

Challenges for GNWT: NO Clear Frontal Ignition

Lack of consistent "ignition" events in the prefrontal cortex at the offset of a stimulus.

Challenges for IIT:

Lack of expected **sustained neural synchronization** patterns within the posterior cortex.

Results suggested sensory and perceptual processing areas might play a more central role than previously thought for both theories.

Consciousness may be more sensory/perceptual than executive

Conscious experience may arise more from perceptual sensory systems than from executive frontal systems.

This shifted attention away from the older idea that consciousness depends mainly on higher-order frontal cognition.

This really screwed up my talks with patients about the value of the frontal lobe. However, the frontal lobe may be the FREE WILL and choice that us humans have.

Is there still a Role of the Prefrontal Cortex: This has always been my big go too with repairing these synapses so we can make GOOD versus Bad conscious choices. But this is not the actual consciousness????

Medial and lateral orbital frontal cortex in addiction

Timing mattered enormously.

The study emphasized that conscious perception involves dynamic temporal processing.

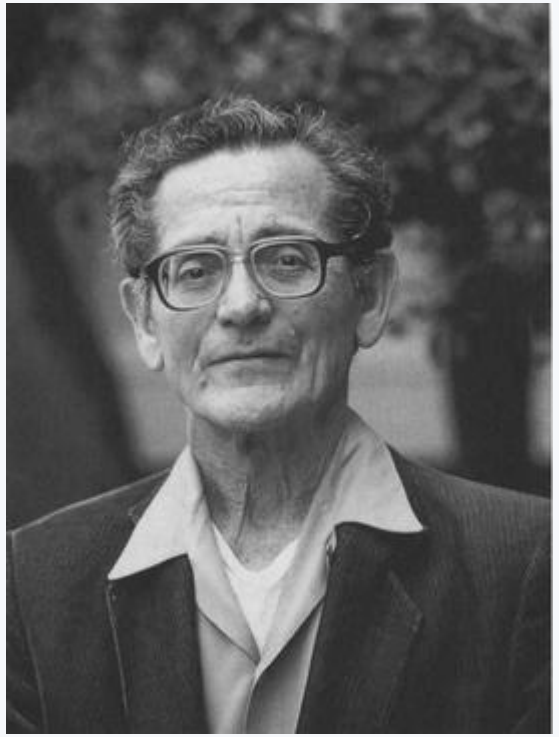
Theories differed not just on *where* consciousness occurs, but *when*.

Researchers found that timing signatures were more nuanced than either theory predicted. Consciousness may involve:

•transient network coordination

•recurrent processing

•evolving cortical states. Not a simple switch.



https://en.wikipedia.org/wiki/Benjamin_Libet#/media/File:Benjamin_Libet.png

Implications for Anesthesia

The paper supports the idea that anesthesia is NOT simply “turning off” the brain. Instead, anesthesia likely disrupts:

•large-scale connectivity
•recurrent processing
•posterior sensory integration

some degree of:
•integration
•coordinated access

Implications for Addiction

Addiction may hijack:
salience networks
conscious access systems
emotional integration systems

Drug cues may dominate attentional broadcasting and integrated self-state processing

Perhaps craving becomes conscious priority and withdrawal becomes integrated threat perception .

Pain and addiction become deeply intertwined conscious states

Implications for Surgical Pain

Conscious pain is not mere nociception.

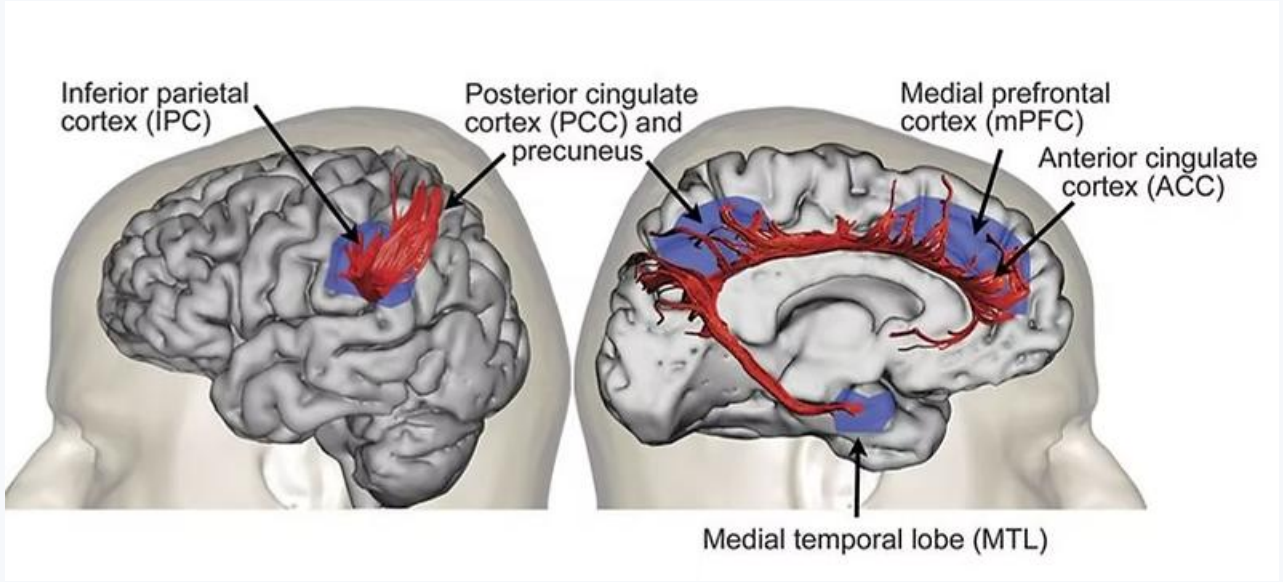
Pain likely requires:
•sensory integration
•temporal persistence
•cortical coordination
•conscious access

This explains why:

•nociception can occur without suffering
•autonomic response can exist without awareness
•anesthesia can separate sensation from conscious experience

Default Mode Network (DMN)

sense of self
autobiographical identity
internal narrative
Reflection meaning
time continuity
moral/emotional self-awareness
In many ways, the DMN is the neural network most :
“the experience of being me.”



Source: Sandrone S , and Catani M Neurology 2013;81:e172-e175

Major regions include: Regions that light up when not active problem solving.
•Dorsal medial prefrontal cortex
•Ventral medial prefrontal cortex
•posterior cingulate cortex
•precuneus
•angular gyrus
•medial temporal structures

Where DMN Fits into the Competing Consciousness Theories

In GNWT (“Gate”)
The DMN may participate in:
•global workspace access
•internal narrative broadcasting
•conscious reflection
•autobiographical reportability

In IIT (“Integrated”)
The DMN may contribute to:
•integrated self-representation
•unified experience
•continuity of conscious identity

In addiction, the DMN may become pathologically organized around:

•craving
•shame
•fear
•compulsive prediction
•withdrawal anticipation
•trauma
•self-loathing
•obsessive drug salience

Addiction narrows consciousness into compulsive self-preservation and craving.

Recovery may require:

•biologic brain stabilization
•restoration of executive control
•reduction in pathological salience
AND
•reorganization of the self-model
That “reorganization of self” is often described spiritually by patients.

Consciousness is not just *where* neurons fire. It is *when* they fire together. Temporal???
Most consciousness research focuses around: ~40 Hz gamma to high gamma >60 Hz

	Frequency (Hz)	Common Associations
Delta	0.5–4 Hz	Deep sleep, unconsciousness, severe brain slowing
Theta	4–8 Hz	Drowsiness, dreaming, meditation, memory/emotion processing
Alpha	8–12 Hz	Relaxed wakefulness, eyes closed rest, calm awareness
Beta	13–30 Hz	Active thinking, attention, anxiety, motor activity
Gamma	**30–100+ Hz**	**Binding, consciousness, integration, attention, perception**

Gamma Synchrony

Gamma oscillations are fast brain rhythms,
generally: $30–100\ \mathrm{Hz}$

Gamma synchrony means:

- groups of neurons oscillate together in phase
- across local or distributed networks
- allowing coordinated information processing

THIS BINDS THE NCC together? Solves the BINDING problem

“Binding Problem”

How does the brain combine:

•color
•shape
•sound
•memory
•emotion
•body sensation
•meaning

ONE unified conscious experience?

You do not consciously experience isolated neurons and independent sensory fragments

You experience:

“I am here”
“this hurts”
“that is my friend”
“I am afraid”
“I need opioids”
“I hear music”

Gamma synchrony was proposed as one mechanism allowing distributed regions to transiently bind together.

Gamma became heavily studied because conscious perception often correlates

•increased gamma power

•long-range synchrony
•recurrent oscillatory coupling

Especially involving: Both GWS and IIT
•thalamocortical loops
•posterior cortex
•frontoparietal networks
•sensory binding systems

This led to the hypothesis:

Consciousness may require **temporally** coordinated neural firing across distributed systems.

The Thalamus is Critical
The thalamus is often called:

“the conductor of the cortical orchestra.”

Gamma synchrony frequently depends on:

•thalamocortical resonance

•corticocortical recurrence

•oscillatory coordination

How Anesthesia Disrupts Gamma

Many anesthetics impair:

•long-range gamma coherence
•phase synchrony
•cortical communication
•temporal binding

Even if neurons still fire.

This is incredibly important.

Under anesthesia:

•neurons may remain active
•sensory systems may partially function
•local processing may continue

BUT:

•synchronized integration collapses

Neuronal activity persists without unified conscious experience.

Addiction Framing

Addiction hijacks conscious salience networks.

Drug-related cues gain:

•preferential synchronization
•attentional capture
•emotional amplification

The addicted brain becomes biased toward:

•opioid-related integration
•withdrawal signaling
•craving states

Gamma Synchrony and addiction potentials

Propofol

↓ long-range gamma synchrony
↑ slow oscillations
Fragments cortical communication

GABA receptors

Ketamine

May preserve or ↑ gamma activity
Disrupts coherent integration

May explain:
- Dissociation
- Dream-like states
- Hallucinations
- Disconnected consciousness

Gamma alone is NOT enough.
Organization of synchrony matters.

NMDA receptors

Opioids & Gamma

Pain, reward, salience, and craving depend on oscillatory synchronization

Chronic exposure may alter:
- Salience processing
- Thalamocortical rhythms
- Reward synchrony
- Default mode interactions

Potential consequences:
- Hypervigilance
- Altered pain perception
- Craving consciousness
- Attentional narrowing

Mu receptors

Gamma waves and Meditation / Mystical States

Advanced meditators sometimes demonstrate:
•unusually coherent gamma synchrony

This has been associated with:
•unity experiences
•altered self-perception
•enhanced awareness

More to study with:
•psychedelics
•ketamine
•spiritual consciousness research

Supports the idea that consciousness depends partly on large-scale temporal coordination.

SPECIAL ARTICLE

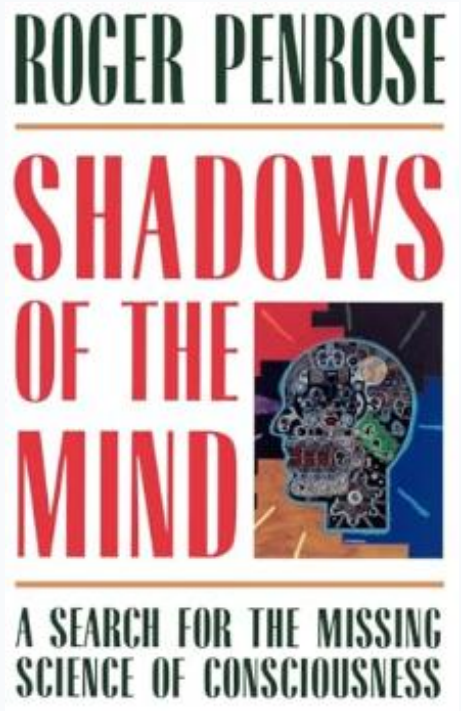
Anesthesiology 2006; 105:400–12

The Entwined Mysteries of Anesthesia and Consciousness

Is There a Common Underlying Mechanism?

Stuart R. Hameroff, M.D.*

Anesthesiology 2006; 105:400–12



Orchestrated Objective Reduction (Orch-OR)
This theory was developed by:
•Roger Penrose
•Stuart Hameroff

Penrose approached consciousness from physics and mathematics.

Hameroff approached it from anesthesia and microcellular brain structure.

Consciousness may arise from quantum computations inside neuronal microtubules.

Relation to Gamma Synchrony
Hameroff and Penrose linked Orch-OR to:
•gamma oscillations
•~40 Hz synchrony
•temporal binding

Coherent quantum events may help organize large-scale neural synchrony.

•gamma rhythms may reflect periodic conscious "moments" But we know it is not consciousness.

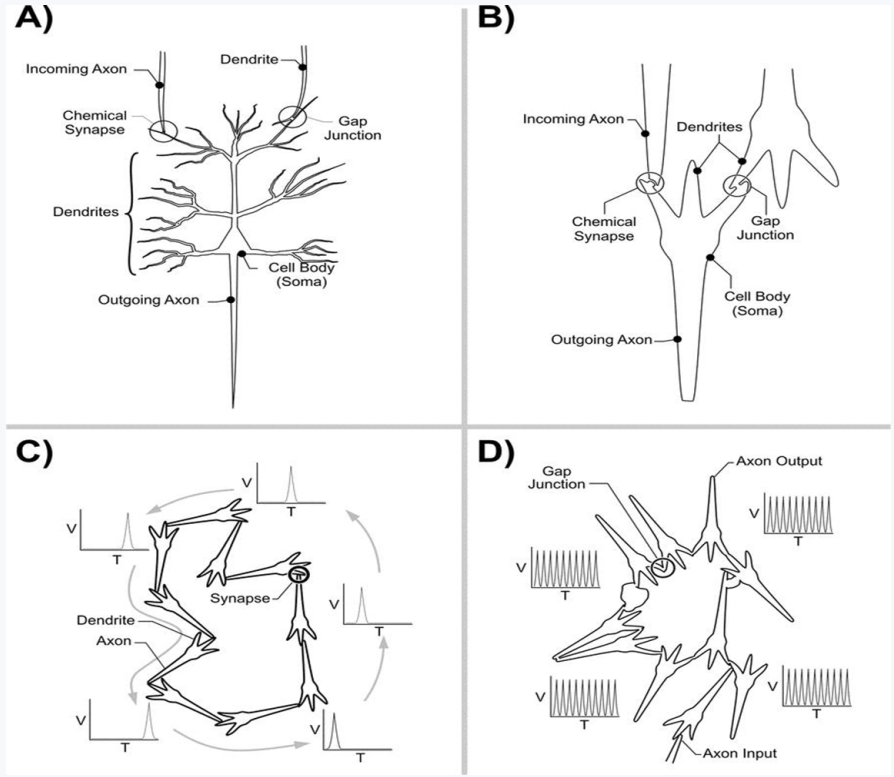
•Microtubules are the KEY

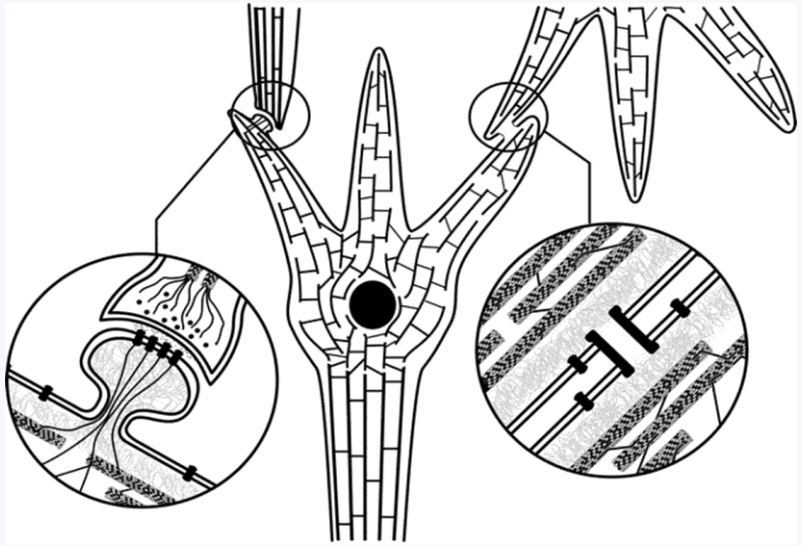
An influential but unproven theory that attempts to explain why subjective experience exists at all.

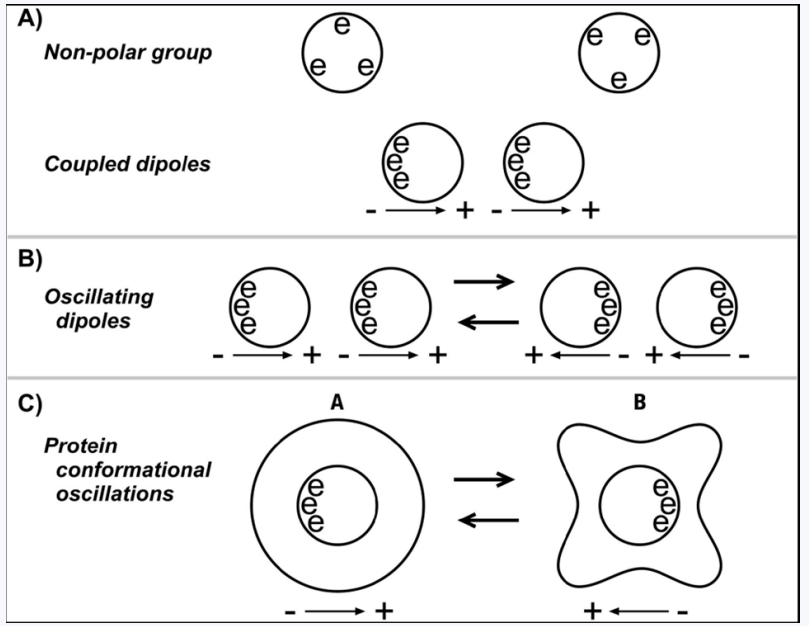
Hameroff:
•anesthetic gases are chemically diverse
•yet all produce unconsciousness
•anesthetics may work by disrupting quantum coherence in microtubules.

This is fascinating because:
•anesthesia reversibly removes consciousness
•without necessarily destroying neuronal activity

What Are Microtubules?
Microtubules are structural proteins inside neurons.
Normally we think of them as:
•cellular scaffolding
•transport systems
•intracellular architecture
Hameroff proposed they may also function as:
•quantum information processors inside neurons.







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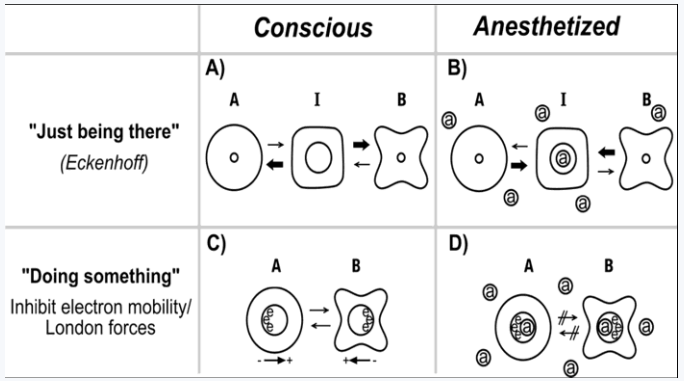


Quantum Mechanics

1. The brain is too warm/noisy for quantum coherence
Quantum states usually decohere rapidly in biological systems.
2. No definitive evidence microtubules perform quantum computation
3. Neural network models explain many features of consciousness without quantum mechanics
4. Orch-OR predictions are difficult to test experimentally

Interestingly, newer discoveries in QM:

- quantum biology
- photosynthesis
- avian navigation
- olfaction

Perhaps the effects come outside of space time?

Addiction injures the biological systems necessary for judgment, salience, reward, and self-control. Part of treatment is helping repair the brain. But many patients also require something deeper.

A transformation in meaning, identity, and connection that patients themselves often describe as a **spiritual awakening.**

Physicians uniquely witness:

- suffering
- mortality
- pain
- fear
- vulnerability
- altered consciousness
- emergence
- loss of control
- human dependence on one another

Perhaps we need to recognize the “Spiritual consciousness” that influences our patients lives.

Christian
Muslim
Jewish
Hindu
Buddha
Mother Earth
Metaverse

Many of our patient's addiction or not have a warped idea of religion but mostly all have faith or are agnostic at a minimum. Carl Jung was a main influence in the science of analytical psychiatry.

Need to tap into that consciousness.

Treat the Brain Disease of Use Disorder

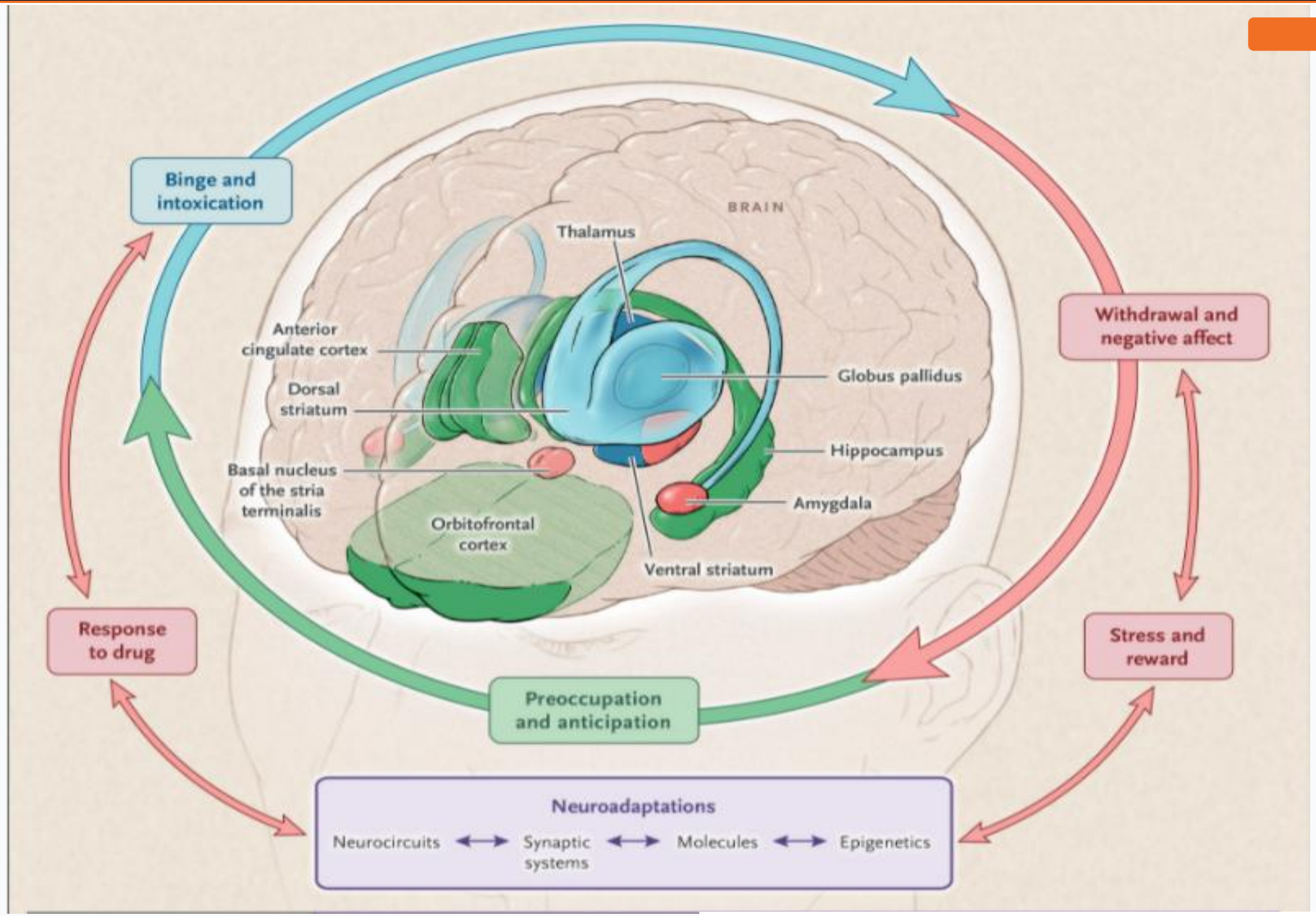
You need medication to get better when sick.

You have a brain disease literally and consciously.

Medication is needed to stabilize this disease process.

Diabetes, HTN, Eye glasses examples

Patients do not like to take their medications!



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Professional Help. Motivational Interviewers. Cognitive Behavioral Therapy

Psychiatry
Counseling
Narcotics Anonymous

By discharge, those who want help, 100% realize they need a multifaceted approach to treat this brain disease.

Addiction as altered salience and reward learning after consciousness has been hijacked.

Reward learning

Cue-driven salience

Craving

Impaired executive control

Persistence despite harm

Addiction is not simply pursuit of pleasure. It is often the pathologic weighting of relief, salience, and learned need.

Repeated drug exposure changes reward, stress, and self-control circuits—and cues become disproportionately powerful.

Pain and addiction at baseline will be amplified with surgery.

Chronic pain if NOT treated for surgery

Threat expectation
Hypervigilance
Recurrent suffering loops

Shared drivers

Salience
Learning
Memory
Reinforcement

Addiction / OUD

Cue capture
Craving
Compulsive reward seeking

Both are disorders of learned experience.

Why this matters perioperatively?

- Opioid tolerance
- Relapse risk
- Withdrawal prevention
- Pain amplification
- Patient expectation
- Regional opportunities
- Discharge planning

Perioperative pain planning is not just a medication choice. It is management of physiology, experience, recovery, and risk.

Core principle for patients with OUD or chronic opioid exposure

Do not destabilize recovery to chase analgesia.

Do not undertreat pain in the name of protecting recovery.

Always hammer home the point that buprenorphine and methadone are strong opioids and great for pain!!

Buprenorphine is an Analgesic

Buprenorphine for Chronic Pain Management 3

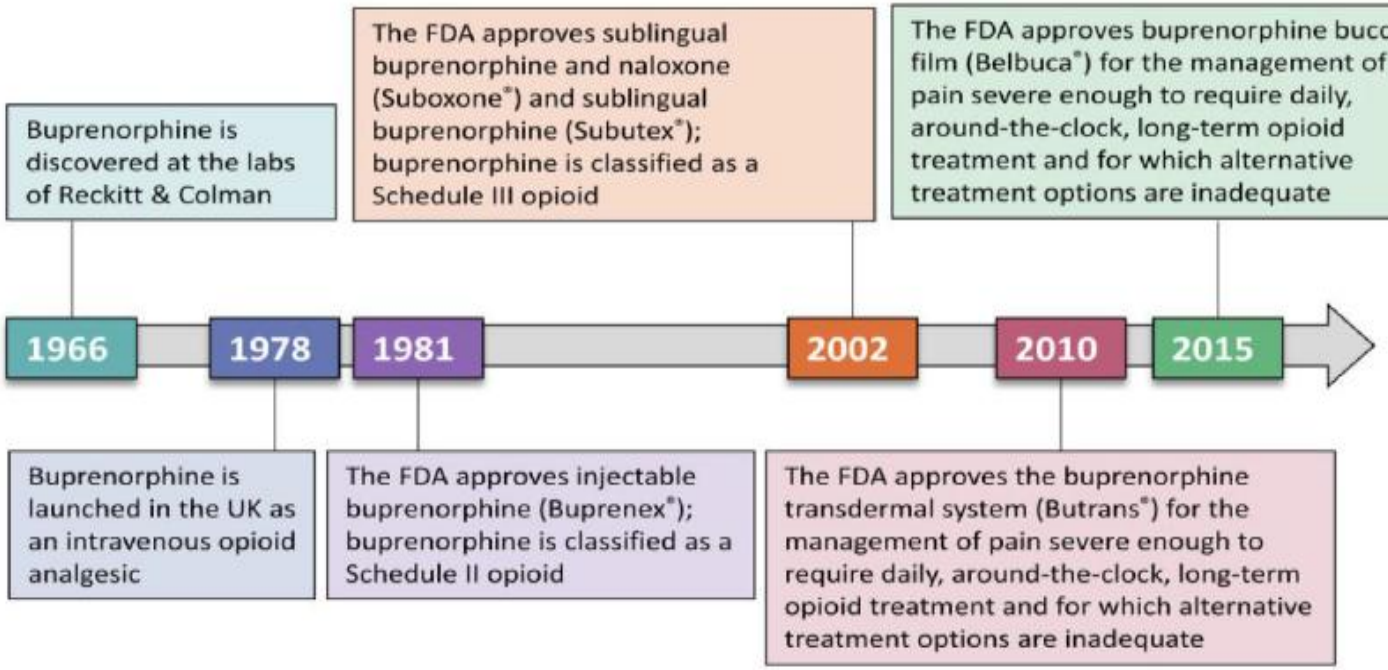
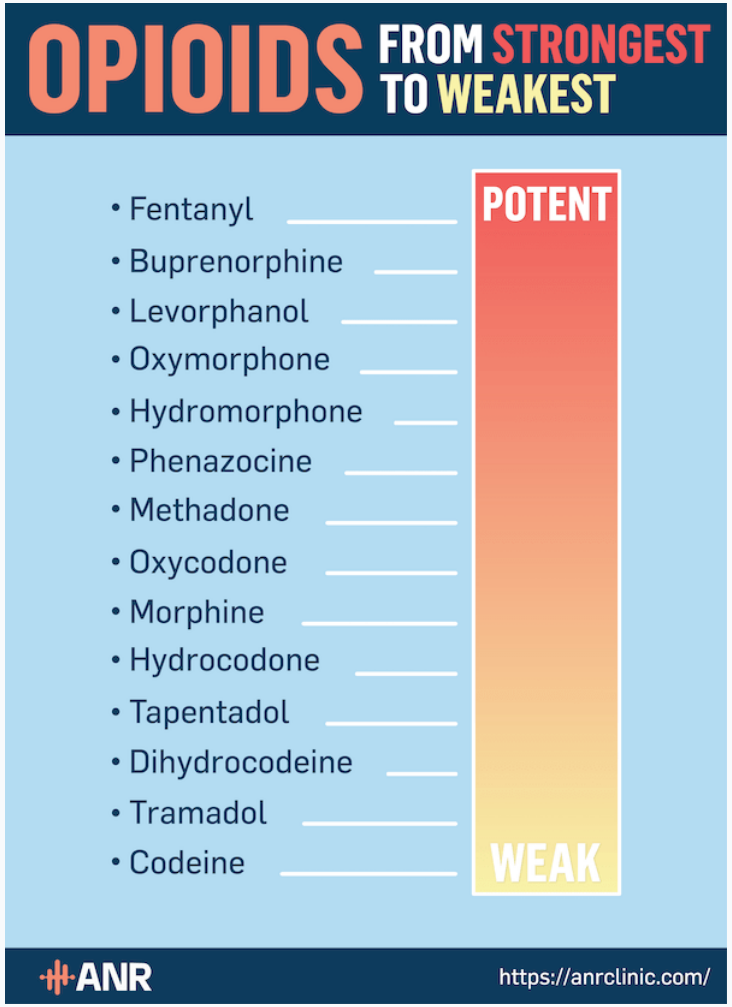
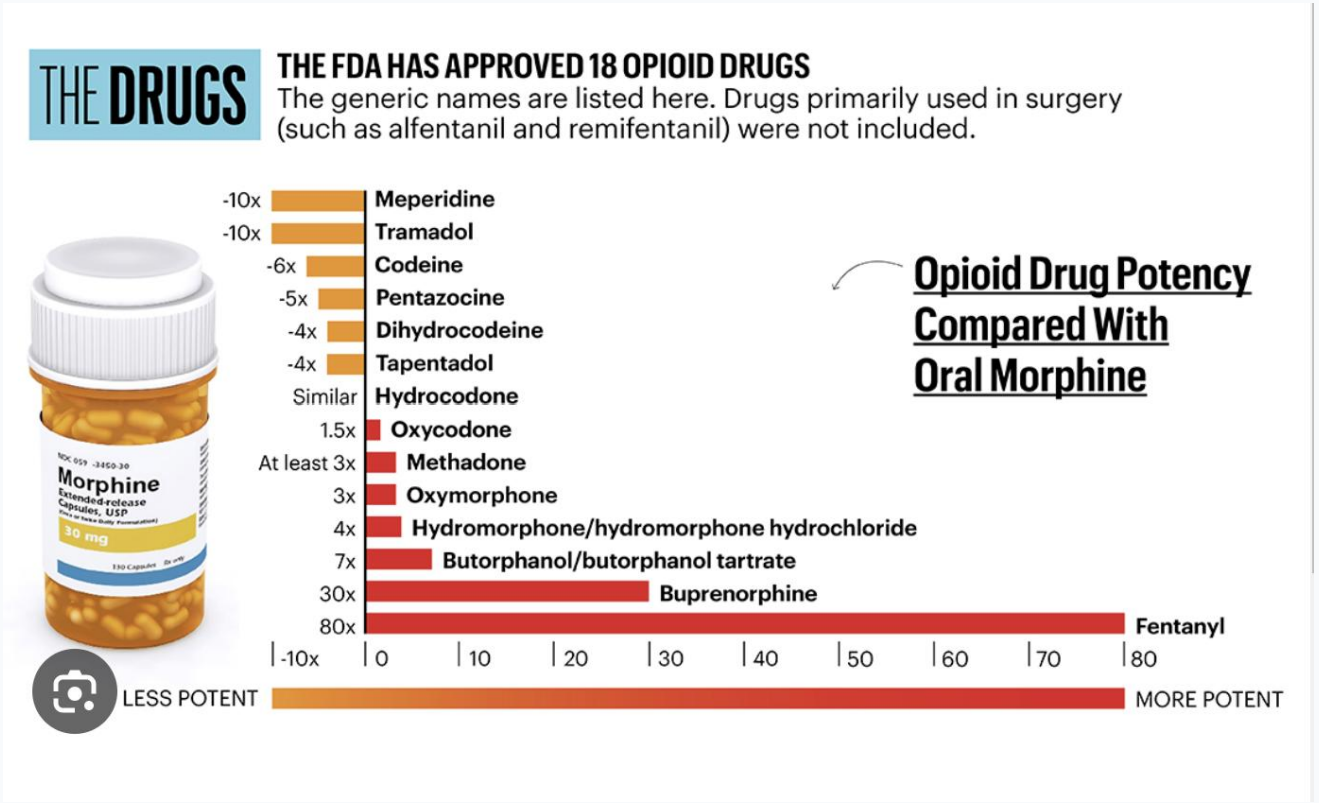


Figure 1. The history of buprenorphine. Buprenorphine was originally developed as an analgesic and was subsequently used for OUD before novel delivery systems allowed for approval in chronic pain management [8,9,12,13]. FDA=Food and Drug Administration; OUD=opioid use disorder.

Webster et al., Understanding Buprenorphine for Use in Chronic Pain: Expert Opinion. Pain Medicine, 0(0), 2020, 1–10
doi: 10.1093/pm/pnz356. Open access article

Explain the power to patients of Buprenorphine to Patients





DO NOT STOP SUBOXONE

- Do not routinely stop buprenorphine before surgery
- Continue in most patients and build a stronger analgesic plan around it
- Use multimodal and regional techniques early
- If pain is significant, add short-acting full agonists thoughtfully
- Coordinate discharge and outpatient follow-up

Why continuation matters

Avoids withdrawal
Reduces destabilization
May lower relapse risk
Prevents chaotic perioperative planning

Methadone: continue the maintenance dose, then treat surgical pain separately

Continue the usual maintenance methadone dose

But remember

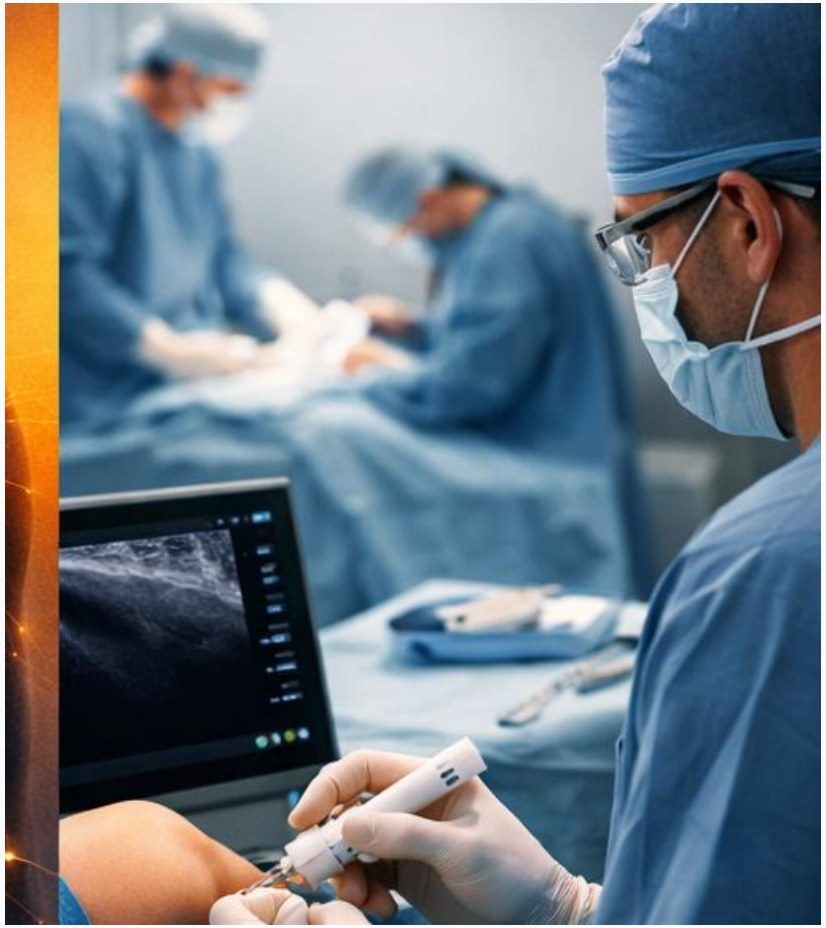
The maintenance dose does not adequately cover acute surgical pain.

Continue methadone to prevent withdrawal and destabilization, then add procedure-specific multimodal and opioid analgesia as needed.

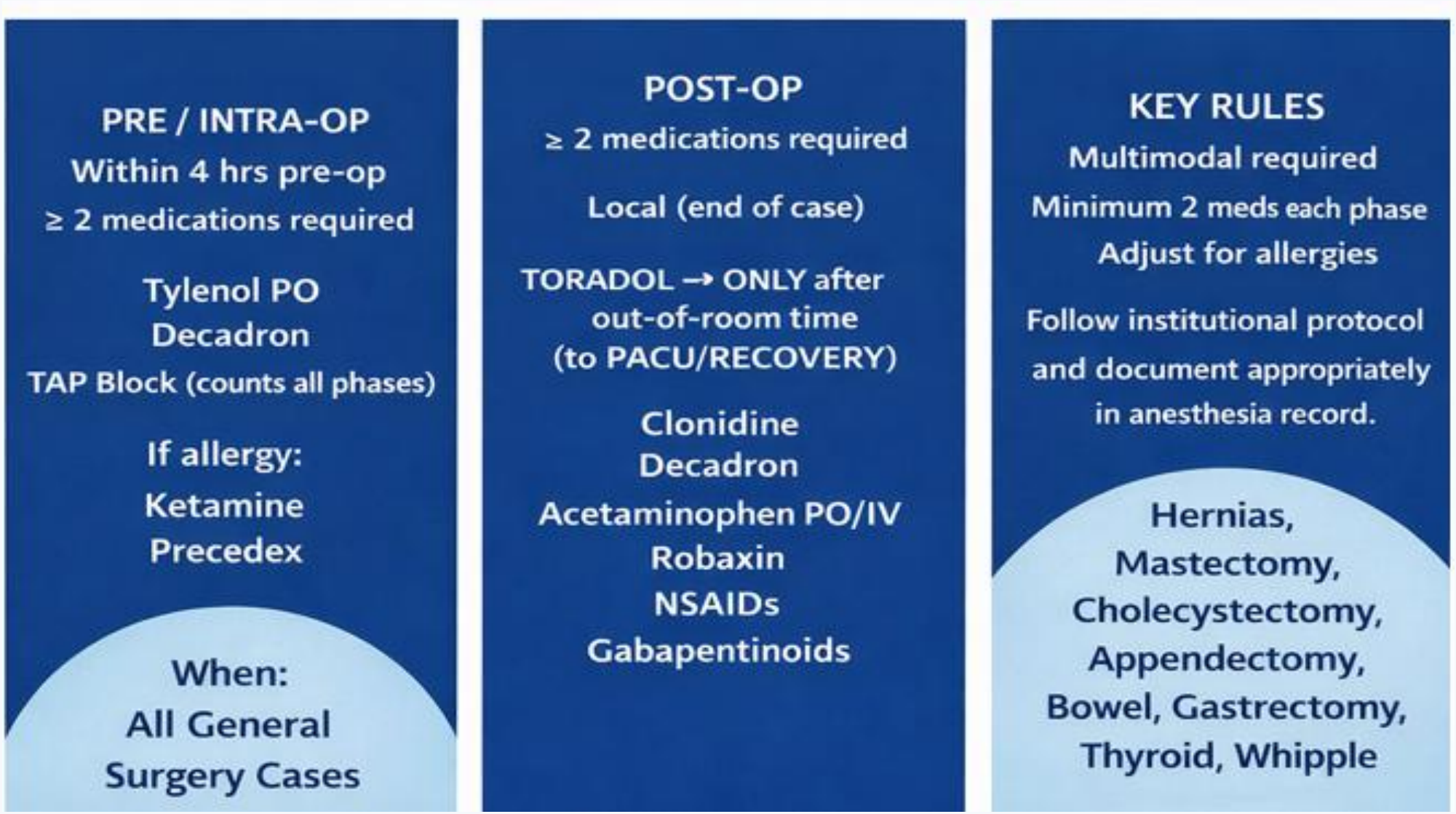
Maintenance methadone protects recovery; it does not replace an analgesic plan. However, we need some expectation management No one is sending you home with 2 weeks of oxy or Dilaudid PCA.

Build the opioid-sparing foundation first

- Peripheral nerve blocks and neuraxial techniques when appropriate
- Continuous catheter techniques for surgeries likely to produce sustained pain
- Acetaminophen and NSAIDs if not contraindicated
- Ketamine, lidocaine infusion, alpha-2 agonists, and other adjuncts as appropriate
- Nonpharmacologic support, expectation-setting, and coordinated team planning



Regional and multimodal analgesia are not decorative extras in MOUD patients. They are the foundation.


PRE / INTRA-OP
Within 4 hrs pre-op
≥ 2 medications required
Tylenol PO
Decadron
TAP Block (counts all phases)
If allergy:
Ketamine
Precedex
When:
All General
Surgery Cases
POST-OP
≥ 2 medications required
Local (end of case)
TORADOL → ONLY after
out-of-room time
(to PACU/RECOVERY)
Clonidine
Decadron
Acetaminophen PO/IV
Robaxin
NSAIDs
Gabapentinoids
KEY RULES
Multimodal required
Minimum 2 meds each phase
Adjust for allergies
Follow institutional protocol
and document appropriately
in anesthesia record.
Hernias,
Mastectomy,
Cholecystectomy,
Appendectomy,
Bowel, Gastrectomy,
Thyroid, Whipple

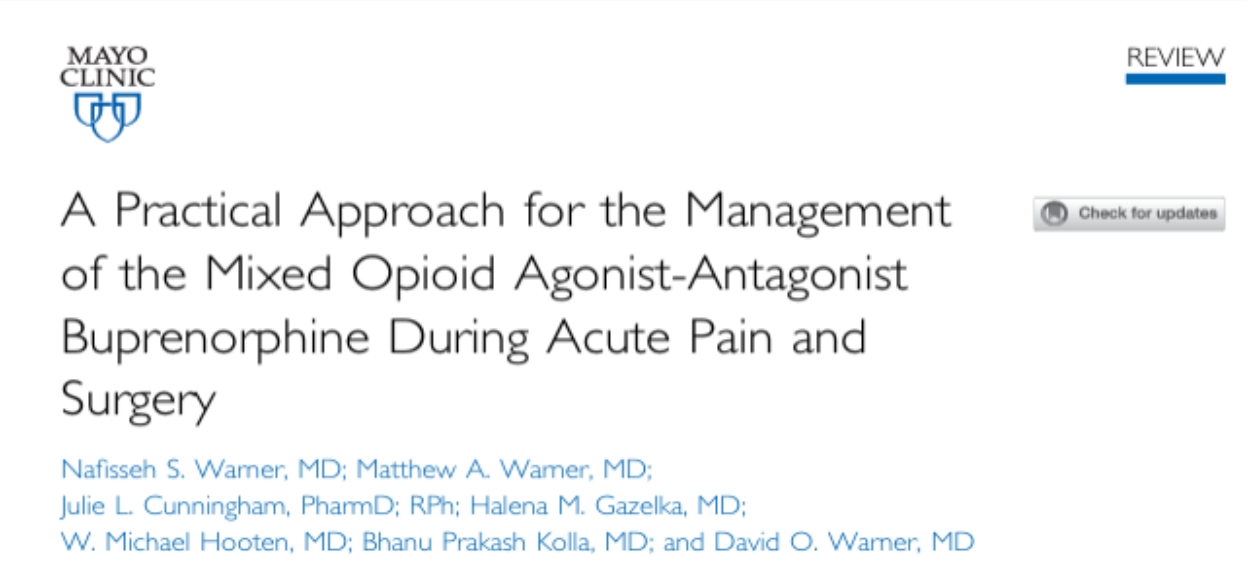
Supplemental full-agonist opioids are still needed

Patients may require higher-than-usual doses of short-acting full-agonist opioids because of opioid tolerance and, with buprenorphine, receptor competition.

Commonly favored choices in guidance: hydromorphone or fentanyl

Use in monitored settings, reassess frequently, and avoid casual escalation.

Better language than “high-dose opioids”



MAYO CLINIC

REVIEW

A Practical Approach for the Management of the Mixed Opioid Agonist-Antagonist Buprenorphine During Acute Pain and Surgery

Check for updates

Nafisseh S. Warner, MD; Matthew A. Warner, MD;
Julie L. Cunningham, PharmD; RPh; Halena M. Gazelka, MD;
W. Michael Hooten, MD; Bhanu Prakash Kolla, MD; and David O. Warner, MD

Don’t take my word for it.

Warner et al. 2020 did allow a selected-patient option of reducing to 8–12 mg SL-equivalent for high-dose patients facing major postoperative pain, but even that paper already said complete discontinuation was not recommended because of relapse/iatrogenic-harm concerns.

Mayo Clin Proc. June 2020;95(6):1253-1267 n https://doi.org/10.1016/j.mayocp.2019.10.007
www.mayoclinicproceedings.org n [a] 2019 Mayo Foundation for Medical Education and Research

CLINICAL PRACTICE GUIDELINE

Executive Summary of the Focused Update of the ASAM National Practice Guideline for the Treatment of Opioid Use Disorder

Karen Crotty, PhD, MPH, Kenneth I. Freedman, MD, MS, MBA, FACP, AGAF, DFASAM, and Kyle M. Kampman, MD, FASAM

J Addict Med • Volume 14, Number 2, March/April 2020

ASRA Pain Medicine Update

Home / News & Publications / ASRA Pain Medicine Update Item

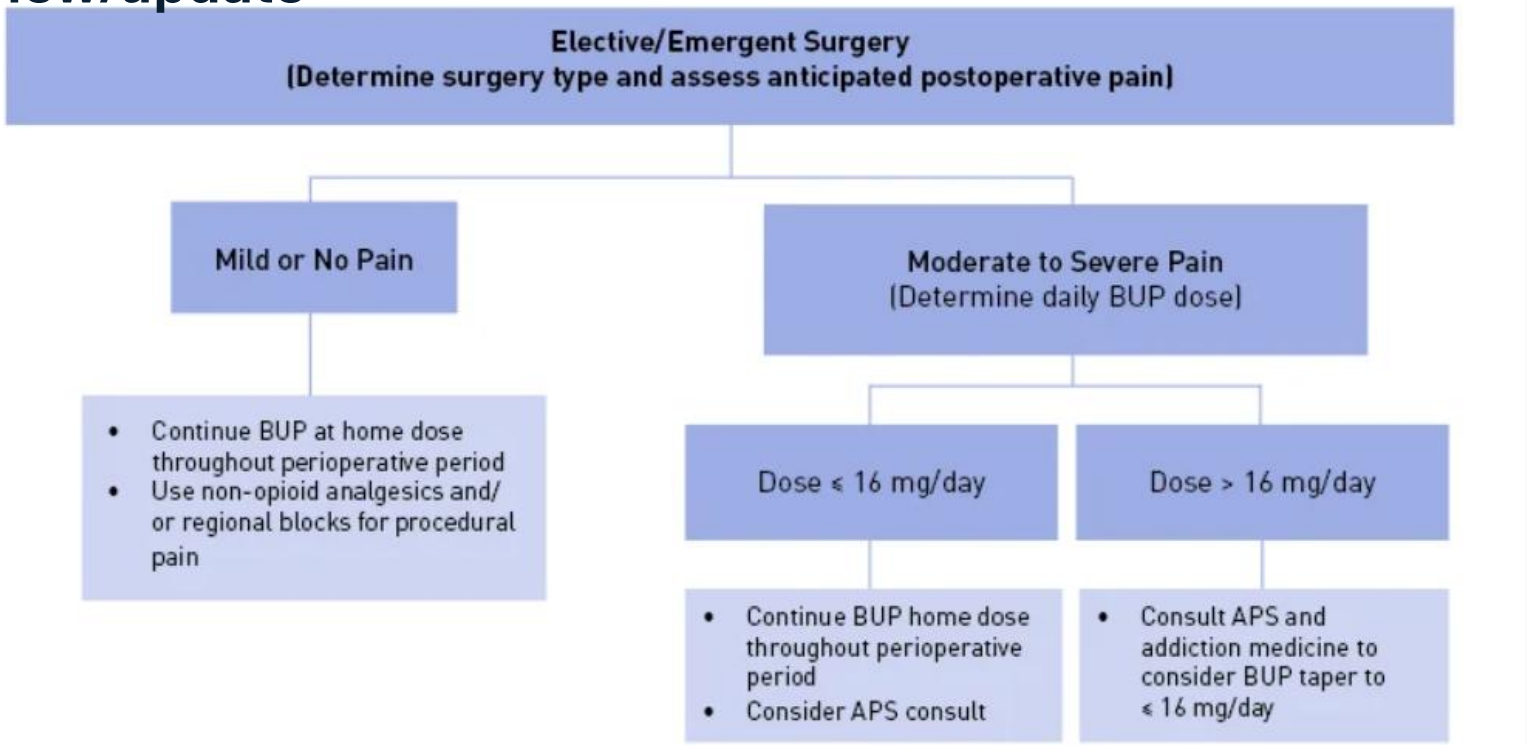
ASRA Buprenorphine Guidance Provides Recommendations for Treating Patients with Known or Suspected Opioid Use Disorder

Aug 12, 2021, 11:33 by ASRA

To decrease the risk of opioid use disorder (OUD) recurrence in patients receiving hospital treatments, buprenorphine should not be routinely discontinued in the perioperative setting. Buprenorphine can be initiated in untreated patients with OUD and acute pain in the perioperative setting to decrease the risk of opioid recurrence and overdose death.

Those are the conclusions of new multidisciplinary guidance on managing patients with known or suspected OUD just been published by *Regional Anesthesia & Pain Medicine*.

ASRA 2023 review/update



- Consider splitting BUP dose into Q6-8 h to provide improved analgesia
- Titrate short acting full agonist opioids to effect as needed and consider close monitoring
- Anticipate opioid tolerance and higher doses of short acting full agonist compared to opioid naive patients
- Use multimodal analgesia to optimize pain control*
- Consider IV opioids or PCAs if patient not tolerating orals

*Multimodal analgesia includes but are not limited to regional techniques, scheduled acetaminophen, NSAIDS if not contraindicated, calcium channel blockers like gabapentin or pregabalin, topical lidocaine, oral and parenteral opioids, intravenous ketamine infusion etc.

BUP —buprenorphine; APS — acute pain service; PCA — patient-controlled analgesia

Selvamani BJ, Kral L, Swaran Singh T. Perioperative management of patients on buprenorphine for opioid use disorder. ASRA Pain Medicine News 2022;47. https://doi.org/10.52211/asra020123.010.

Perioperative Considerations for Medications for Opioid Use Disorder

Buprenorphine, Methadone, or Naltrexone

T. Kyle Harrison, MD[a,*], Howard Kornfeld, MD[b], Anuj Kailash Aggarwal, MD[c]

Table 2
Perioperative plan for medications for opioid use disorder dosing

Drug	Preoperative	Day of Surgery	Postoperative
Buprenorphine	Continue daily dose Document buprenorphine provider's contact information for postoperative follow-up	Patient should receive usual daily dose Plan for multimodal pain management	Continue daily dose but consider switching to tid dosing Consider increasing buprenorphine to target pain Continue multimodal pain management Arrange for follow-up with buprenorphine provider early in the postoperative period Discharge with the lowest dose and shortest duration of additional opioids as possible
Methadone	Continue daily dose Document methadone dose and methadone provider's contact information for postoperative follow-up	Patient should receive usual daily dose. If unable to take PO, give IV (reduce dose by one-half to two-thirds and split into tid dosing) Plan for multimodal pain management	Continue daily dose but consider switching to tid dosing Continue multimodal pain management Arrange for follow-up with methadone provider early in the postoperative period If daily dosing patient may need to go to methadone clinic postoperatively Discharge with the lowest dose and shortest duration of additional opioids as possible
Naltrexone	Oral—discontinue >48 h preoperatively XR-NXT—discontinue 30 d preoperatively	Confirm last dose >48 h for oral and >30 d for implanted XR-NXT Plan for multimodal pain management	Continue multimodal pain management Patient may be more sensitive or less sensitive to opioids Resume after patient has been off opioids for 7 d

Anesthesiology Clin 43 (2025) 645–658
https://doi.org/10.1016/j.anclin.2025.07.004
anesthesiology.theclinics.com 1932-2275/25/Published by Elsevier Inc

Why This Matters in Primary Care

We need to block pain transmission to your brain any way we can. If there is a nerve, it can be blocked!

My favorite blocks:
Spinal
Epidural
Interscalene and Supraclavicular
Erector spinae block
popliteal
Adductor
Paravertebral
Fascia Iliacus Block
PENG

Expectation Management

Spinal and Epidural Neuraxial Anesthesia

Block type / target

Single-shot neuraxial injection into the intrathecal (CSF) space.

Produces dense sensory and motor block below the anesthetic level.

Block type / target

Needle/catheter placed in the epidural space outside the dura.

Can be titrated for analgesia (catheter) or denser surgical anesthesia.

Typical indications

Fast, reliable surgical anesthesia below the umbilicus.

Common when a dense block and limited duration are desired.

Epidural: Major thoracic, abdominal, vascular, or lower-extremity surgery

Postoperative pain control when an infusion is desired

Typical surgeries

Cesarean delivery
Total hip/knee arthroplasty
Hip fracture fixation
Perineal or urologic surgery
Labor and cesarean delivery
Open abdominal surgery
Thoracotomy or rib-fracture pathways
Complex lower-extremity surgery

Pearls / cautions

BLOOD THINNERS ARE BAD

Rapid onset; sympathectomy may cause hypotension and bradycardia.

Common teaching complications: post-dural puncture headache, urinary retention, rare neurologic or hematoma concerns.

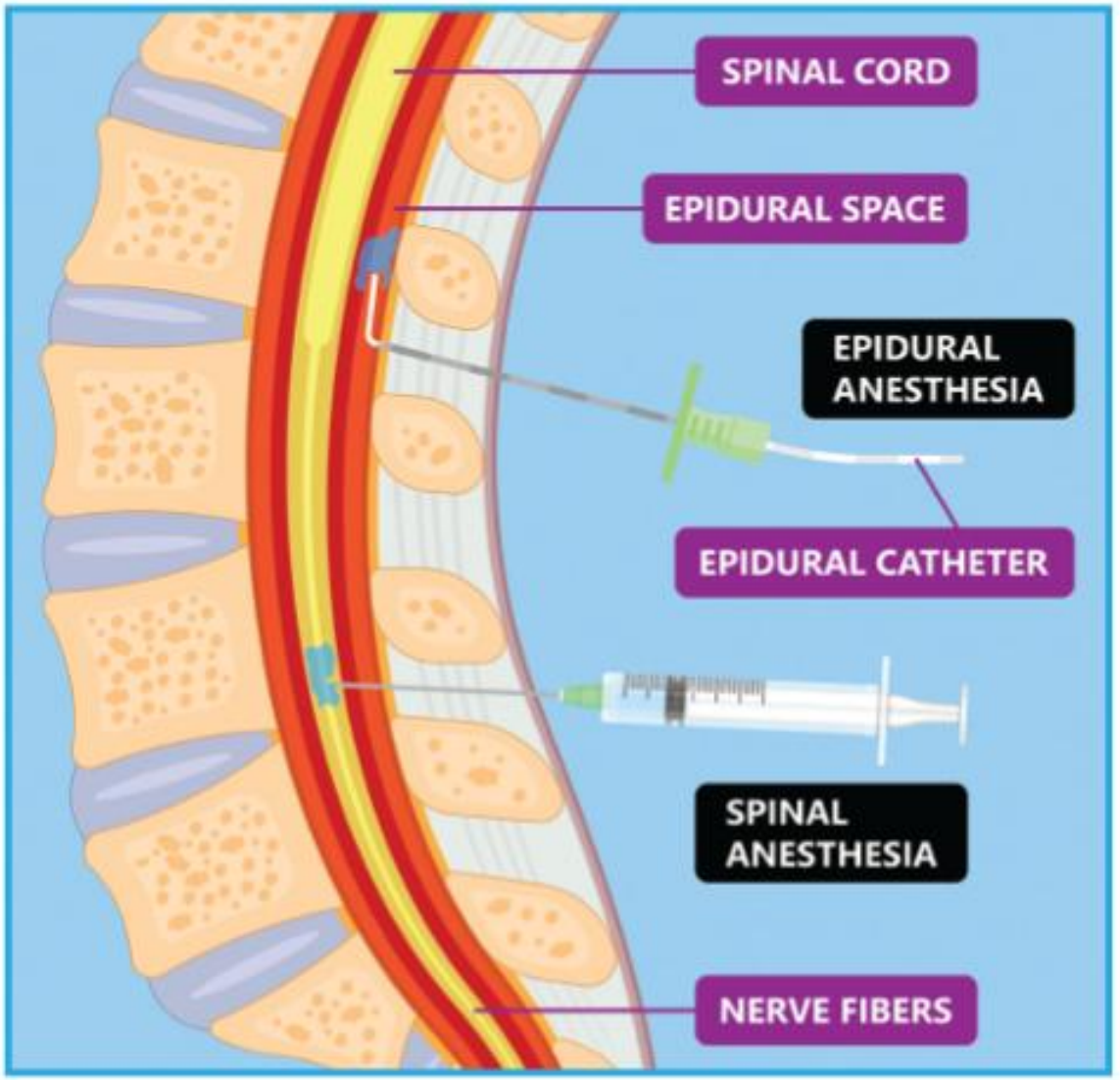


Image: Epidural and spinal anaesthesia.
ID: 1769472851. www.shutterstock.com

Interscalene and Supraclavicular Blocks

Interscalene

Targets brachial plexus roots/trunks between the anterior and middle scalene muscles.

Best for shoulder and proximal humerus surgery.

Supraclavicular

Targets plexus trunks/divisions above the clavicle.

Excellent “all-purpose arm block” for elbow, forearm, wrist, or hand surgery.

Typical surgeries

Shoulder arthroscopy or arthroplasty (interscalene)

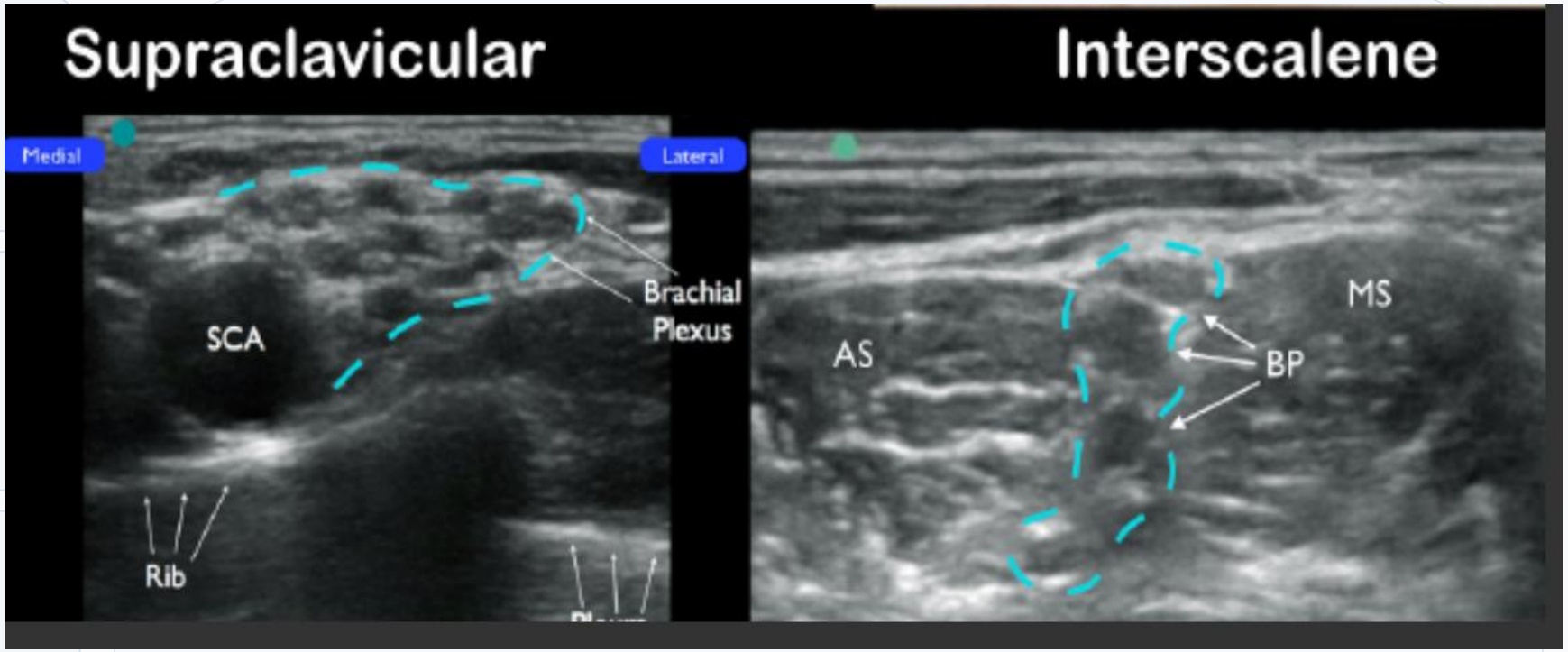
Clavicle/proximal humerus surgery (interscalene)

Upper-extremity surgery distal to the shoulder (supraclavicular)

Pearls / cautions

Interscalene commonly causes temporary ipsilateral hemidiaphragm weakness.

Supraclavicular requires pleural awareness because the plexus lies near the subclavian artery and pleura.



https://www.acepnow.com/article/how-to-perform-ultrasound-guided-interscalene-nerve-blocks/2/

Interscalene = shoulder block. Supraclavicular = arm/forearm/hand block.

Erector Spinae Plane Block

Block type / target

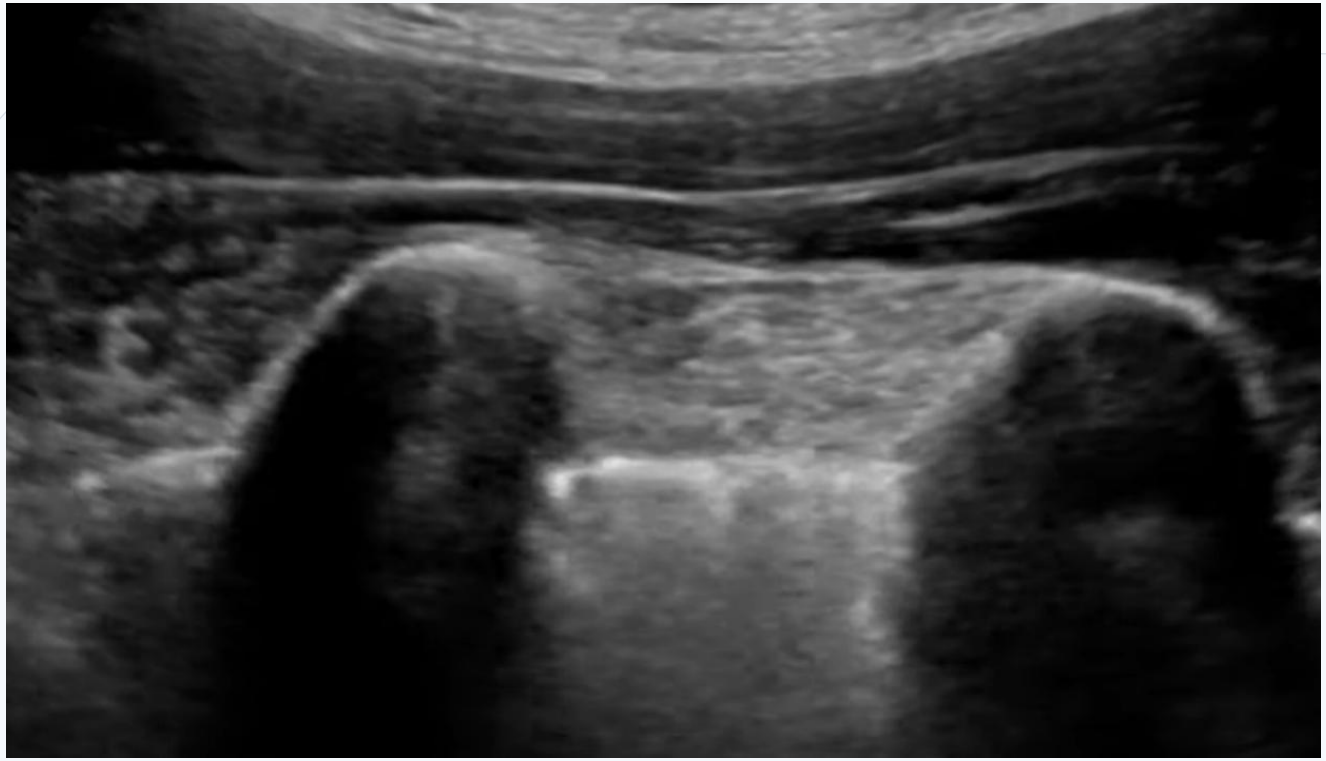
Fascial plane injection deep to the erector spinae muscle and superficial to the transverse process.

Typical indications: I use for TONS

Thoracic or abdominal wall analgesia
Rib fractures

Typical surgeries

Breast surgery
Thoracic surgery / VATS pathways
Hernia or laparoscopic abdominal surgery
Rib-fracture analgesia



Duke Anesthesiology
Duke University School of Medicine

https://www.youtube.com/watch?v=O9RB0K7f8pM

Thoracic Paravertebral Block

Block type / target

Injection in the thoracic paravertebral space, where spinal nerves emerge from the intervertebral foramina.

Typical indications

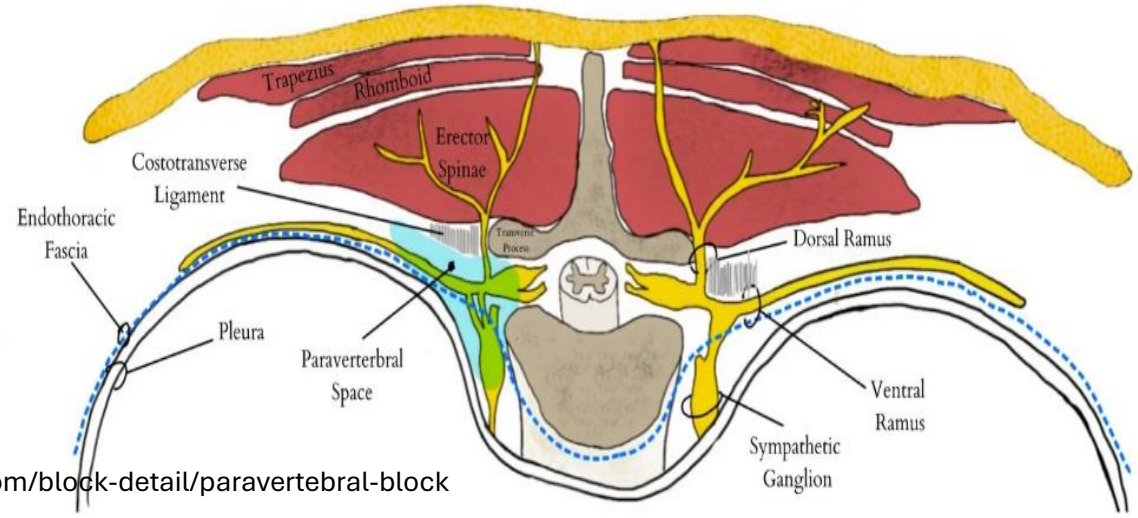
Unilateral chest wall or thoracic analgesia.

Typical surgeries

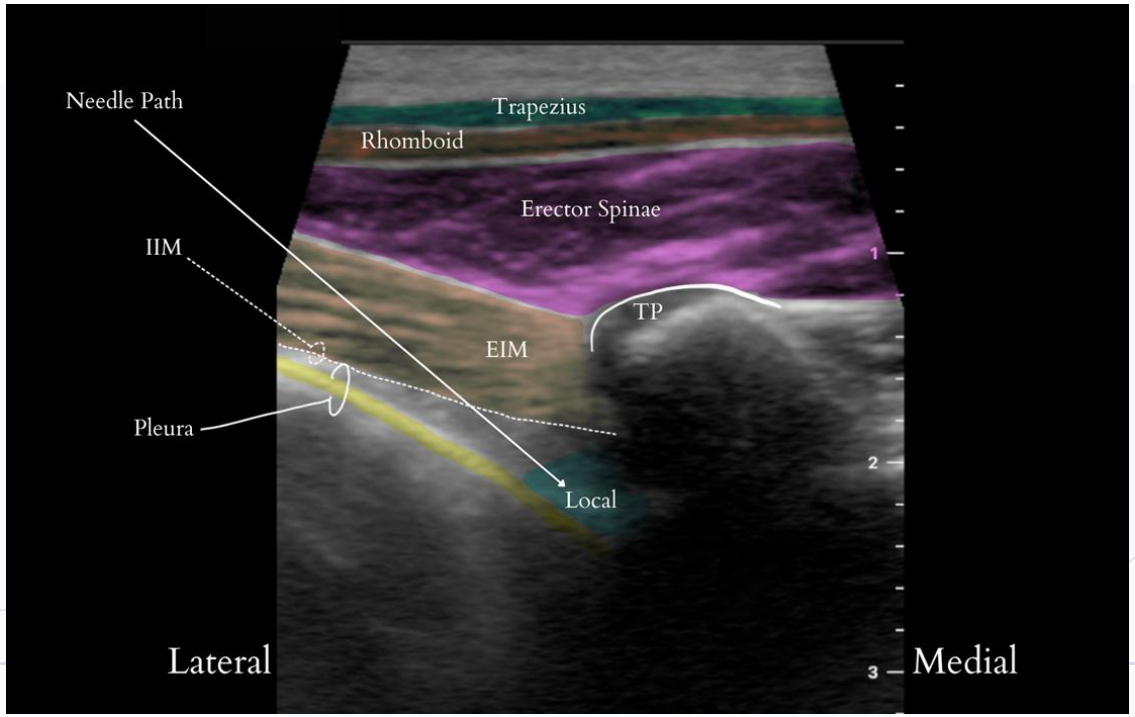
Breast surgery
Thoracic surgery
Rib-fracture pathways
Chest-wall procedures

Pearls / cautions

A useful alternative to thoracic epidural in selected cases.
Important nearby structure: pleura.
PNEUMOTHORAX



https://www.baby-blocks.com/block-detail/paravertebral-block



Popliteal Sciatic Block

Block type / target

Sciatic nerve in the popliteal fossa, often near its tibial/common peroneal bifurcation.

COMBINE with Adductor Saphenous

Typical indications

Foot and ankle analgesia/anesthesia

Often paired with a saphenous block for medial ankle or foot coverage

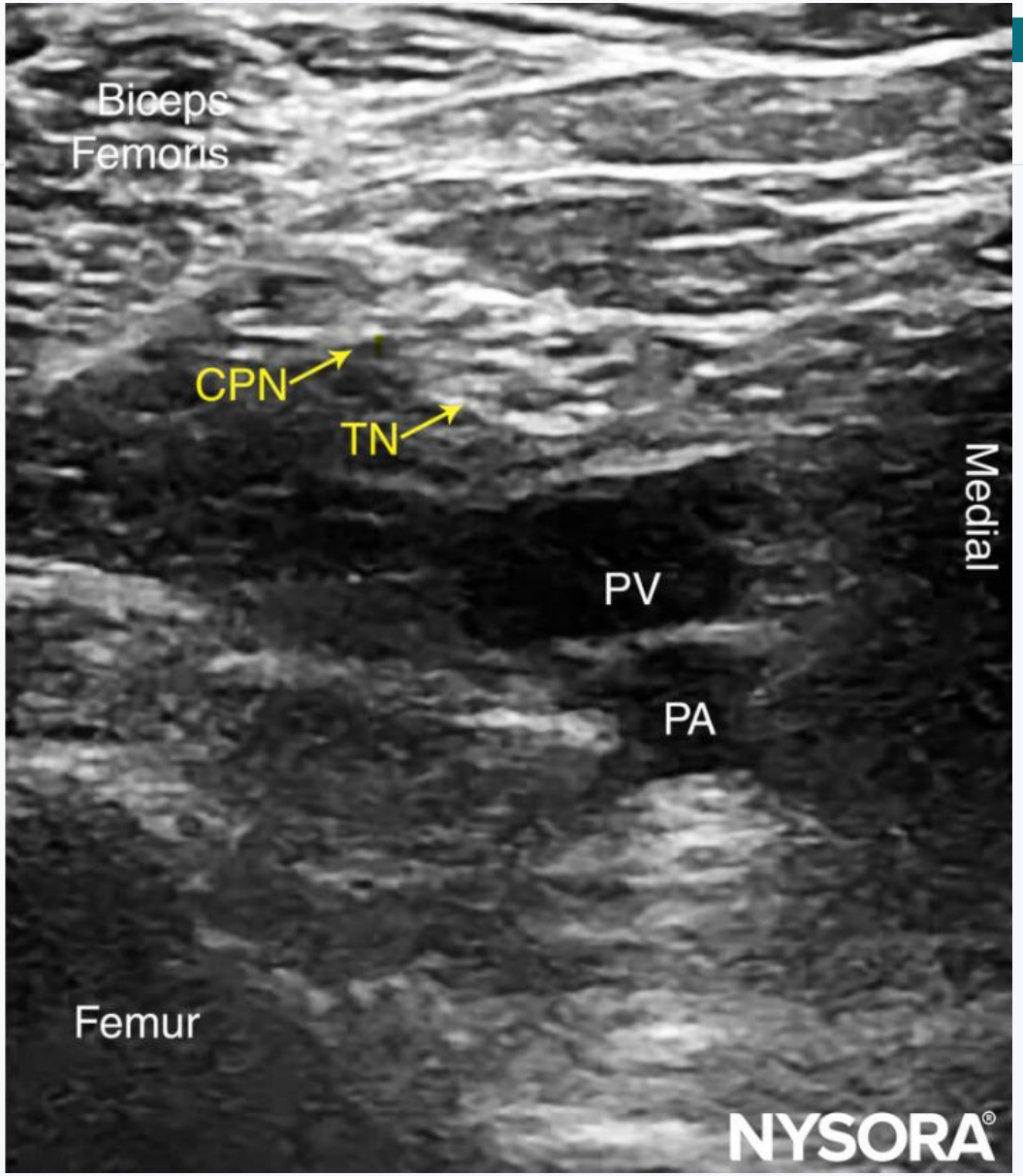
Typical surgeries

Ankle ORIF

Achilles repair

Foot reconstruction

Hindfoot or forefoot surgery



https://www.nysora.com/topics/regional-anesthesia-for-specific-surgical-procedures/lower-extremity-regional-anesthesia-for-specific-surgical-procedures/foot-and-anckle/ultrasound-guided-popliteal-sciatic-block/

Adductor Canal Block

Block type / target

Targets the saphenous nerve within the adductor canal, adjacent to the femoral artery under sartorius.

Typical indications

Knee analgesia when preservation of quadriceps strength is desirable.

Typical surgeries

Total knee arthroplasty

ACL reconstruction

Knee arthroscopy

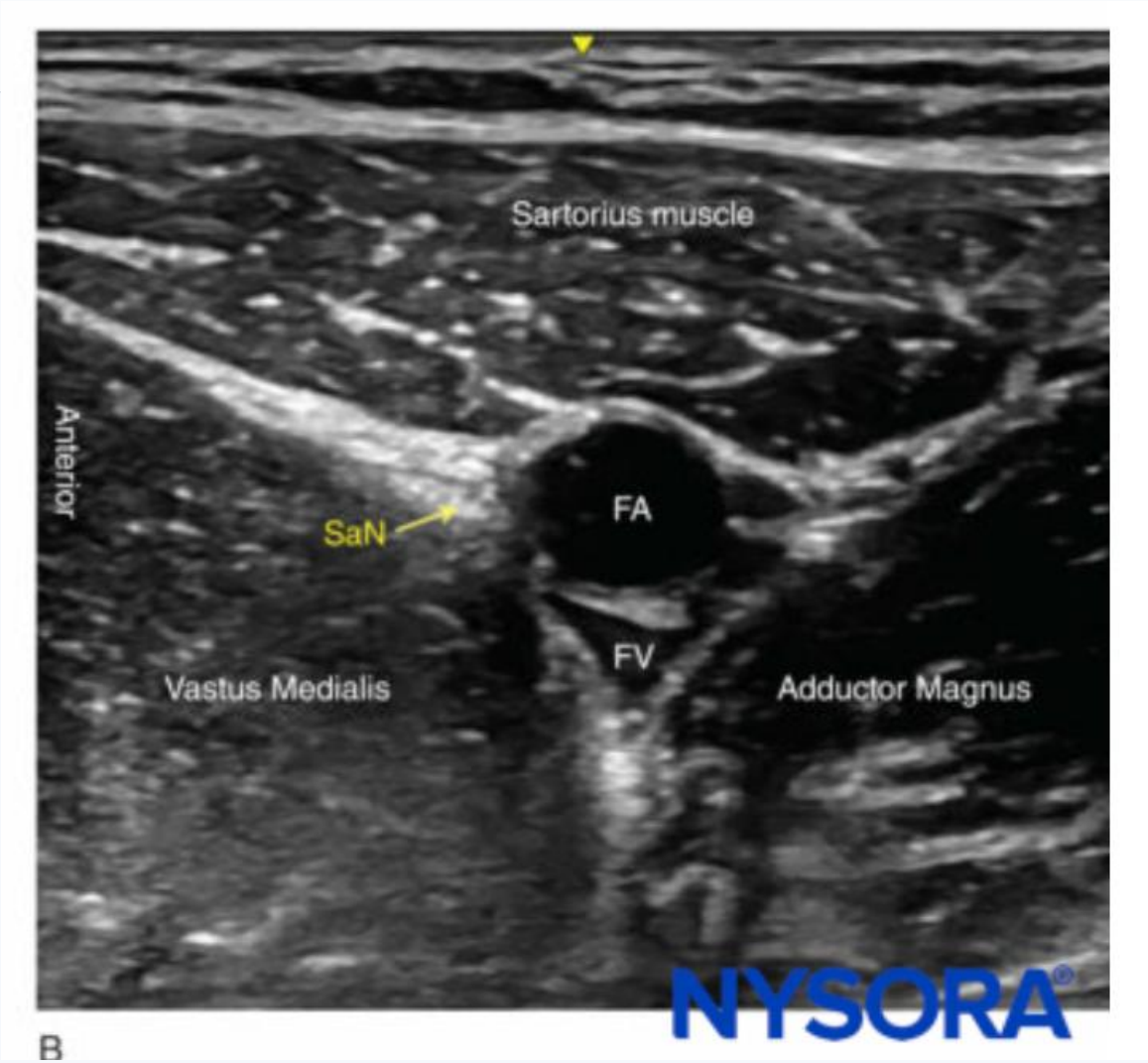
Medial leg/ankle analgesia as an adjunct

Pearls / cautions

Usually more sensory than motor compared with a femoral nerve block.

Add in IPAK

Commonly used in enhanced-recovery knee pathways.



https://www.nysora.com/topics/regional-anesthesia-for-specific-surgical-procedures/lower-extremity-regional-anesthesia-for-specific-surgical-procedures/foot-and-anckle/ultrasound-guided-saphenous-subsartorius-adductor-canal-nerve-block/

Fascia Iliaca Block

Block type / target

Large-volume fascial plane block beneath the fascia iliaca.

Designed to spread to femoral and lateral femoral cutaneous nerves, sometimes obturator contributions.

Typical indications

Hip-fracture analgesia

Preoperative pain control in ED or ward settings

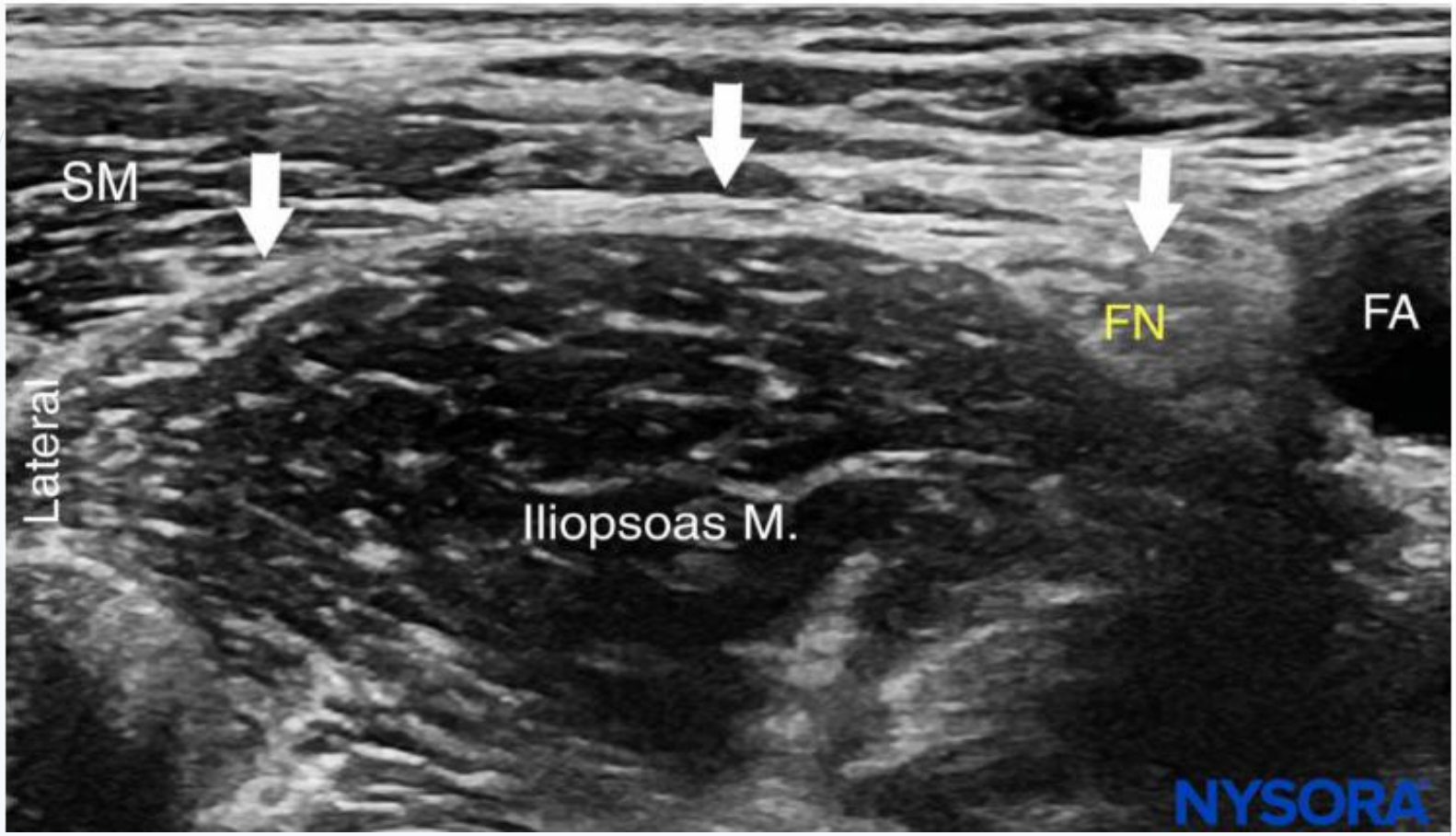
Supplemental anterior-thigh analgesia

Typical surgeries

Hip fracture fixation

Hip arthroplasty

Femoral-neck procedures



https://www.nysora.com/topics/regional-anesthesia-for-specific-surgical-procedures/lower-extremity-regional-anesthesia-for-specific-surgical-procedures/ultrasound-guided-fascia-iliaca-block/

PENG Block

Block type / target

Pericapsular nerve group block targeting articular branches to the anterior hip capsule.

Typical indications

Hip-fracture pain

Preoperative hip analgesia

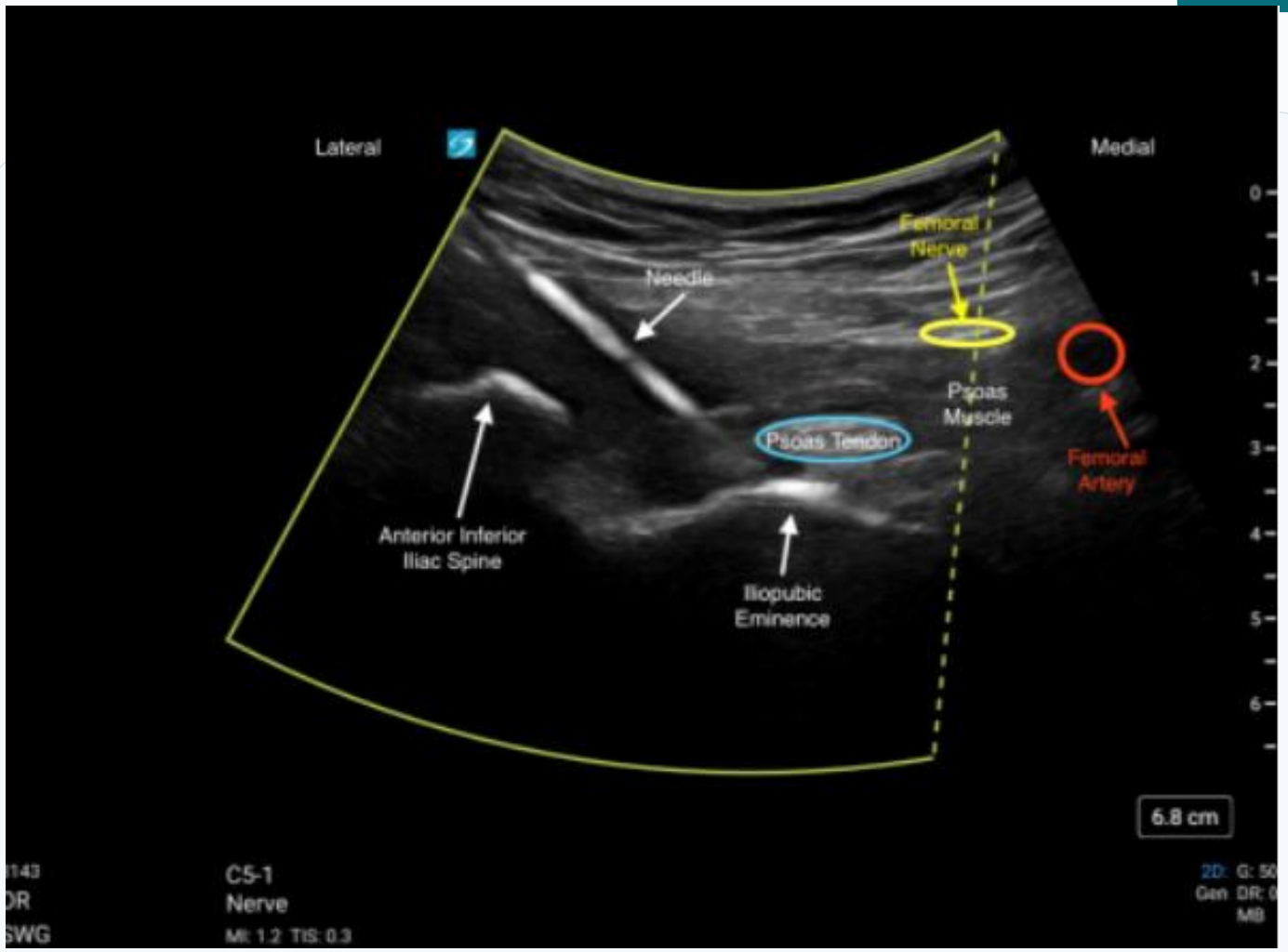
Adjunct for hip arthroplasty pathways

Typical surgeries

Hip fracture fixation

Hip arthroplasty

Hip dislocation reduction or painful hip procedures



https://www.sonosite.com/education/learn/how-perform-peng-block

Continuous Peripheral Nerve Catheters: On-Q and AmbIT Pumps

What they are

A perineural catheter continuously infuses local anesthetic near a nerve or fascial plane.

Used when prolonged analgesia is helpful after ambulatory surgery.

Typical surgeries

Shoulder surgery (interscalene catheter)

Total knee arthroplasty or ACL reconstruction (adductor canal)

Foot/ankle surgery (popliteal catheter)

Abdominal wall or chest wall surgery

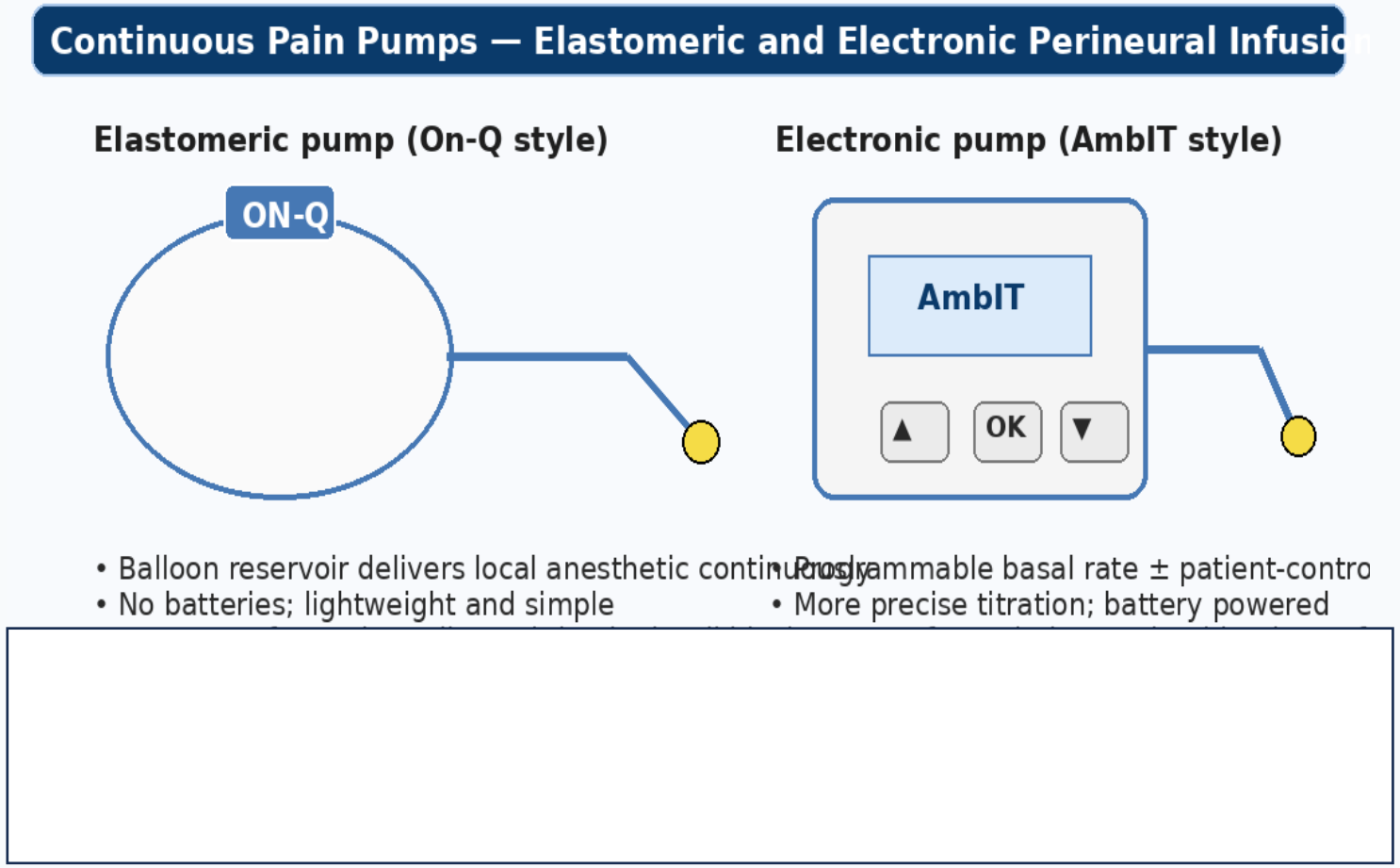
Practical PCP counseling

Protect the numb extremity; use sling/crutches as instructed.

Expect numbness ± weakness in the target area while the pump is running.

Know removal plan, troubleshooting number, and expected stop date.

Call anesthesia urgently for metallic taste, tinnitus, confusion, seizure, dyspnea, escalating redness, fever, or uncontrolled pain.



Bottom Line for Family Practice

What to remember

Regional anesthesia is common, highly effective, and usually opioid-sparing.

Upper-extremity blocks: interscalene (shoulder) and supraclavicular (arm/forearm/hand).

Lower-extremity blocks: adductor canal (knee), popliteal (foot/ankle), fascia iliaca and PENG (hip).

Truncal blocks: erector spinae and paravertebral for rib, breast, chest wall, or abdominal surgery.

Neuraxial techniques: spinal and epidural provide dense surgical or analgesic block below the insertion level.

If a patient has unexpected prolonged numbness/weakness, dyspnea, local-anesthetic toxicity symptoms, or catheter-site infection concerns, contact the block/anesthesia team.

Questions PCPs often get

“How long should the numbness last?” — often 8–24 hours for a single-shot block, longer with additives or catheters.

“Why is my leg weak?” expected with some blocks; review fall precautions.

“Can I remove the pump?” yes, many programs provide phone guidance and a simple pull-out catheter technique.

“When should I worry?” fever, progressive swelling, severe shortness of breath, confusion, metallic taste, ringing in the ears, or severe pain despite the pump. Facial droop

CLOSE

Monitoring, handoff, and discharge are part of analgesia

- Closer PACU or inpatient monitoring when requirements are high
- PCA when appropriate and staffing allows it to be used well
- Early acute pain, addiction, or perioperative medicine involvement when available
- Taper short-acting inpatient IV opioids before discharge when feasible
- Communicate the plan back to the outpatient buprenorphine or methadone prescriber.

CLOSE

Key Points:

- Our patients are complex conscious beings. In my opinion, nothing is more important than developing consciousness.
- The 2 leading models for consciousness are the Global Workspace Theory and the Integrated Information Model. Prefrontal cortex is not as important as we thought and the posterior brain may have more importance than previously thought. NCC, Gamma waves and DMN all part of it.
- Quantum mechanics may be a fun way to explain things happening simultaneously at 2 different locations, and time seems to be important.
- Addiction and chronic pain both involve altered salience, learning, and reinforcement.
- Buprenorphine and methadone are treatments for Brain Disease.
- For patients on buprenorphine or methadone: continue MOUD, maximize multimodal and regional care, and use supplemental opioids thoughtfully when needed.

The goal is not to choose between addiction treatment and pain treatment. The goal is to protect recovery while treating pain well.