

**IEEE EMBS FORUM
GRAND CHALLENGES IN NEUROENGINEERING
BETHESDA, MD**

**Deciphering How the Brain Represents Information in
Health and Disease:
Characterizing Loss of Consciousness under
General Anesthesia**

Emery N. Brown

**Department of Anesthesia, Critical Care and Pain Medicine
Massachusetts General Hospital
Harvard Medical School**

**Department of Brain and Cognitive Sciences
Harvard/MIT Division of Health Sciences and Technology
Massachusetts Institute of Technology**

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What is General Anesthesia?

A drug-induced, **reversible** condition comprised of

Hypnosis (loss of consciousness)

Amnesia (loss of memory)

Analgesia (loss of pain perception)

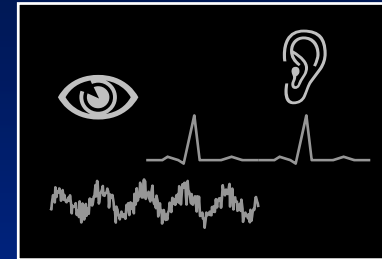
Akinesia (loss of movement)

and

Stability and Control of the cardiovascular, respiratory thermoregulatory and autonomic nervous systems.

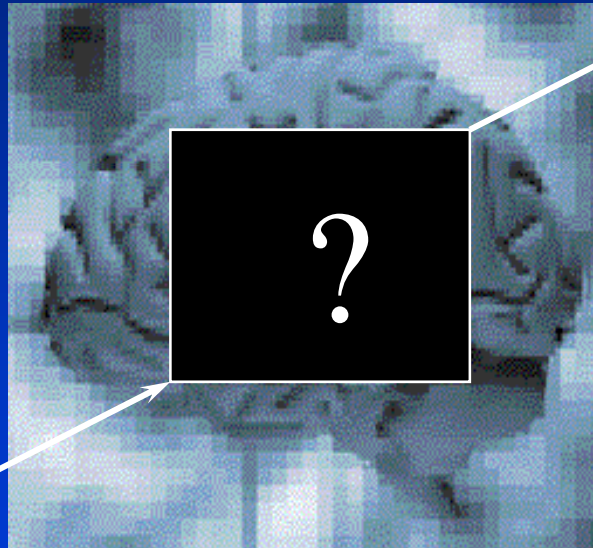
How Drugs Cause General Anesthesia is Unknown?

Current State of Anesthesiology Research



Behavioral States

Hypnosis
Amnesia
Analgesia
Akinesia
Homeostasis

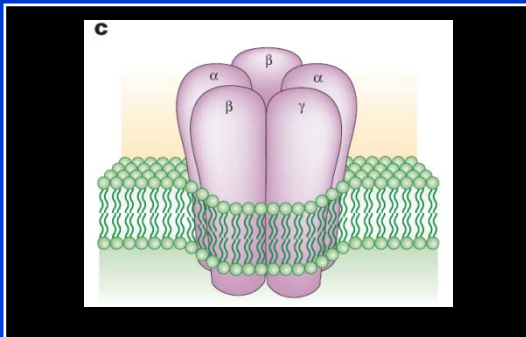


Neural Circuits

Arousal
Memory
Somatosensation and Pain
Movement
Autonomic and Cardiovascular Control

Specific Molecular Receptors

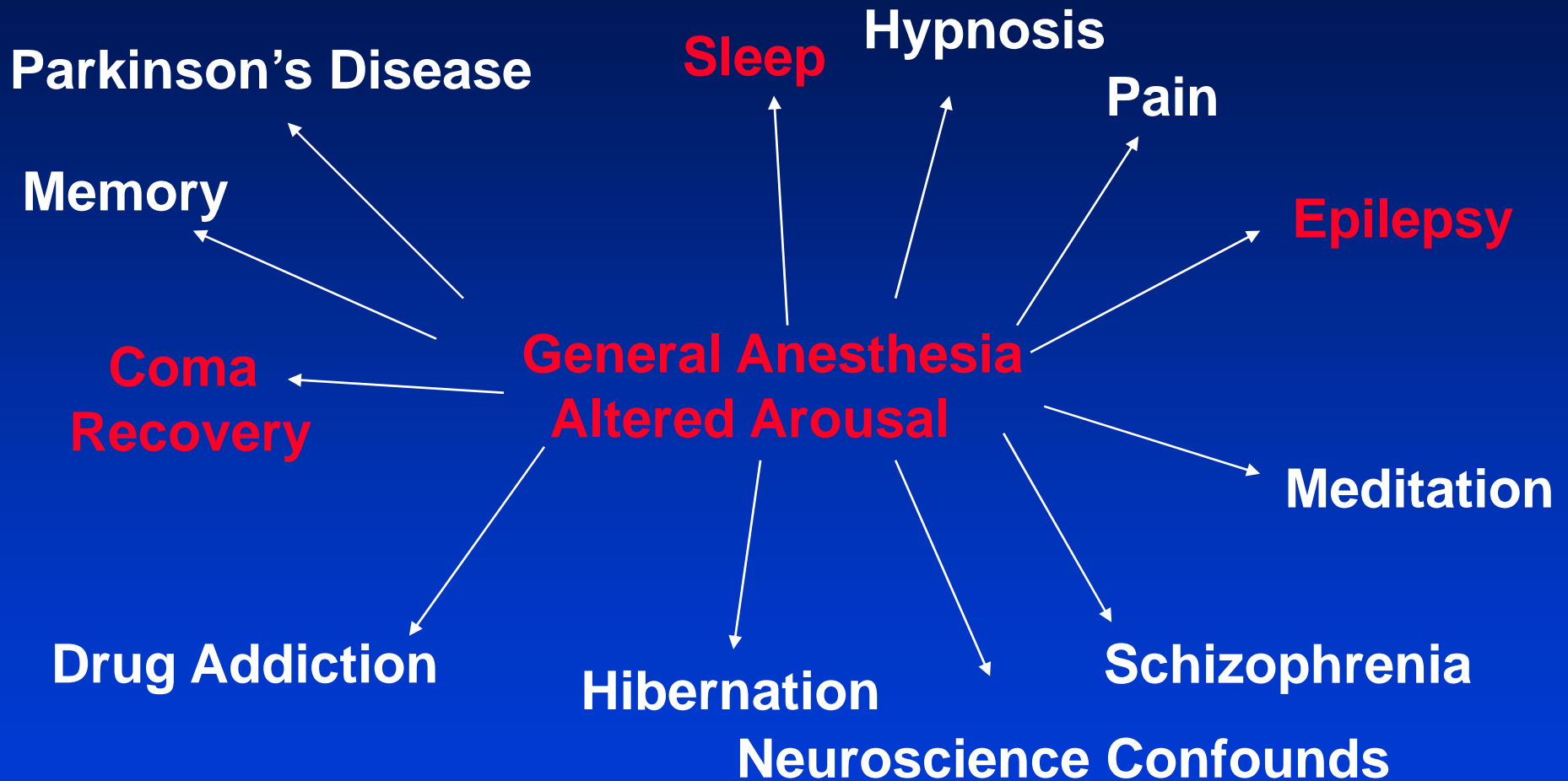
GABA_A
NMDA
Alpha Adrenergic
Glycine and Glutamate
Cholinergic Receptors



Anesthetic Drugs

- Amnesia (benzodiazepines, inhalational drugs)
- Analgesia (opioids, inhalational drugs)
- Hypnosis (barbiturates, propofol, inhalational drugs)
- Immobility (anticholinergics, inhalational drugs)
- Hemodynamic Stability

The Grand Challenge of General Anesthesia



Realize Its Unique Potential as a Clinical Neuroscience Discipline

Specific Challenges

Human Neurophysiology Experimentation

Data Recording and Data Storage

Neural Signal Processing and Data Analysis

High-Dimensional Modeling

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