SIRIUS Neuroscience Study

A structured framework for studying neural mechanisms and translating findings



Table of Contents

01 SIRIUS Neuroscience Study Template

02 Neurobiological Context and Relevance

03 Anatomical Targets and Pathways

04 Experimental Methodology Stack

05 Neural Activity and Electrophysiology

06 Behavioral Correlation and Results

07 Mechanism of Action and Model

08 Clinical Translations and Neurotherapeutics

SIRIUS Neuroscience Study Template

Study title and thesis

Study title, neural domain, and a one-line research thesis for fast audience alignment

Author and institution

Author or lab name plus institution to anchor credibility and collaboration context

Date and series

Date and symposium/lecture series label for consistent event branding across venues

Accent palette mapping

Neon-cyan and violet accent palette mapped to neural signal and mechanistic emphasis

Study aims and metrics

Replace placeholders with your study's exact aims, hypotheses, and outcome metrics



Neurobiological Context and Relevance

Circuit computation problem

Cellular and circuit-level problem statement: what computation or dysfunction the brain circuit performs

Disease and symptom relevance

Neurological relevance: connect to disease mechanism, symptom dimensions, or neural computation deficits

Neural signature distinction

Core biological question: identify the measurable neural signature that distinguishes normal vs pathological states

Predicted neural changes

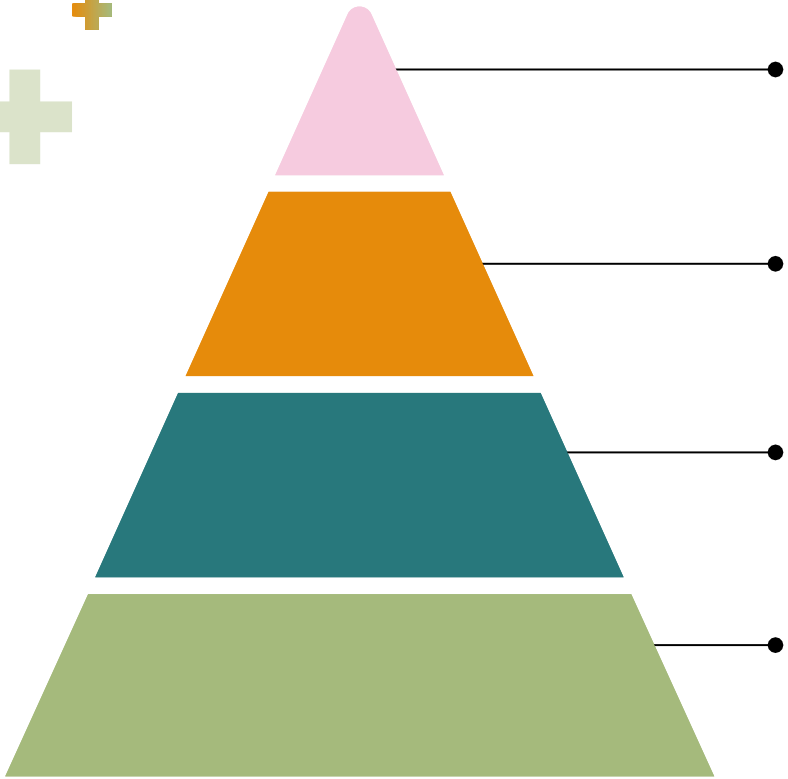
Hypothesis framing: expected directionality for firing, synchrony, oscillations, or plasticity markers

Causal design controls

Design constraints: what must be controlled (state, stimulus, motion, sampling bias) to claim causality



Anatomical Targets and Pathways



Pathway coordinates

Show afferent/efferent links and label recording/stimulation coordinates

Striatum role

State action selection or habit circuitry role and the downstream pathway to motor or cognitive output

Hippocampal contribution

Specify memory/sequence contribution and the projection route linking to cortical dynamics

Cortical computation

Define the cortical computation and layer-level target for the primary recording or stimulation site

Experimental Methodology Stack

01

Model and controls

Subject selection, baseline state, counterbalancing, and exclusion criteria are prepared as model and controls

02

Neural data acquisition

Choose fMRI, patch-clamp, optogenetics, and define sampling rate, resolution, and targets for acquiring neural data

03

Perturbation delivery

Stimulation parameters, light wavelengths, patch-clamp protocols, and timing relative to task events are used to deliver perturbations

04

Behavioral paradigm

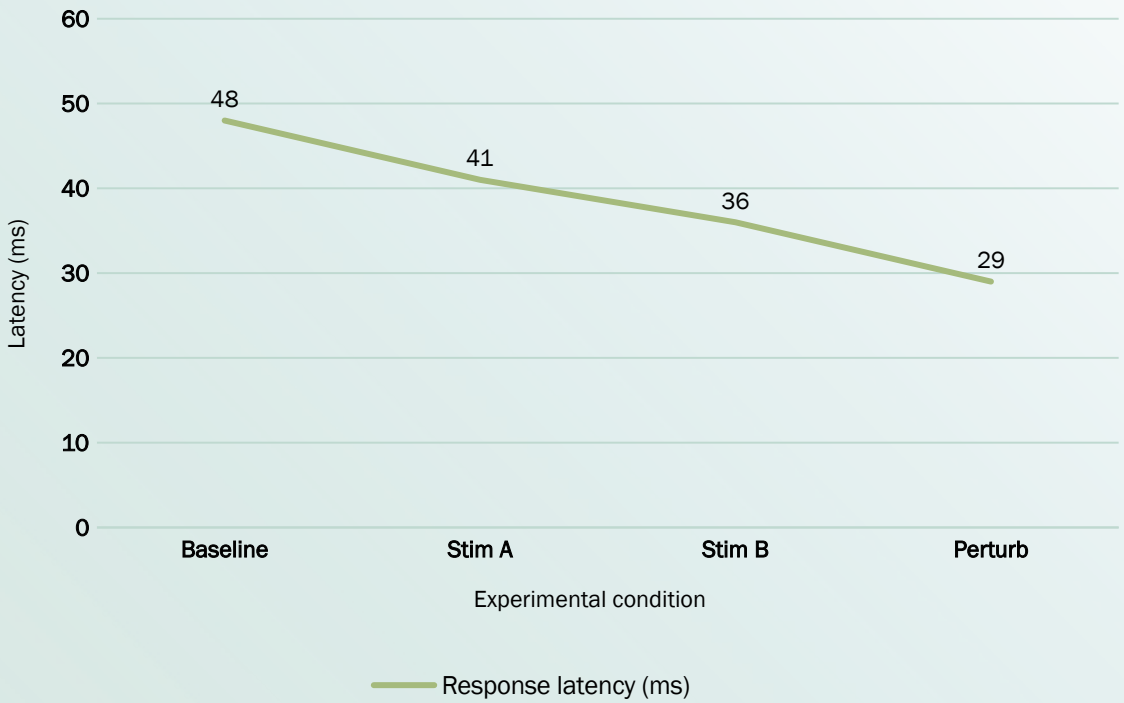
Specify task design, metrics, and synchronization to neural timestamps when running the behavioral or stimulus paradigm

05

Preprocessing and QC

Motion correction, spike sorting, filtering, artifact rejection, and a blinded analysis plan are applied during preprocessing and quality-checking

Neural Activity and Electrophysiology



Condition-linked latency

Response latency decreases across conditions, from 48.0 ms at Baseline to 29.0 ms under Perturb, indicating condition-linked neural timing changes.

Behavioral Correlation and Results

Neural-to-behavior correlation

Correlate spike timing, oscillatory power, or fMRI activation with accuracy, reaction time, or error type

VS

Effect size and robustness

Show effect size and directionality plus robustness checks to support a mechanistic interpretation

Mechanism of Action and Model

01

Pathway activation

Pathway activation drives synaptic state changes at the targeted circuit nodes

02

Recurrent computation

Recurrent dynamics reshape firing rates, synchrony, and phase relationships

03

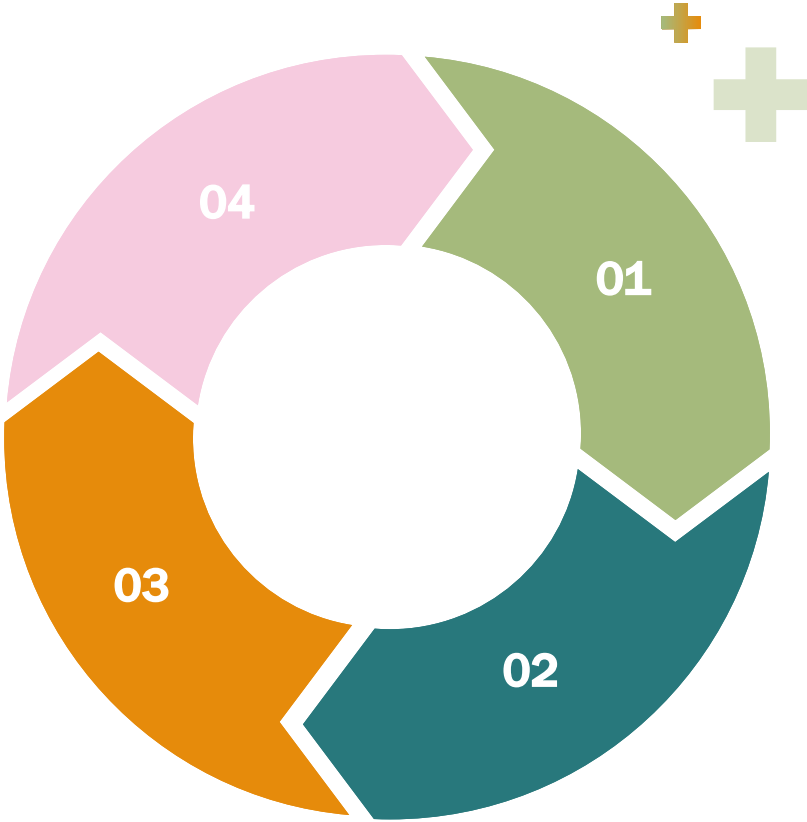
Synaptic plasticity

Activity-dependent learning rules adjust weights or excitability across sessions

04

Behavioral output

Updated circuit state produces observable phenotype changes in the task



Clinical Translations and Neurotherapeutics

Therapeutic implications

Map the identified mechanism to targetable nodes (receptors, pathways, stimulation sites)

Neurotechnology roadmap

Propose biomarkers, closed-loop readouts, and intervention modality fit for translation

Future targets

Specify next experiments that validate causality and improve generalization across cohorts

Citations and evidence

Include key prior studies and your strongest supportive results