Talk to the point and don’t write stories!!!!!

Each paragraph should have only one main takeaway explicitly.

Avoid jargons. In required places, explain the jargon properly.

Make each sentence not more than 2.5 lines

# **Introduction**

## Decision making during uncertainty

* + Start off with general statements on decision making during uncertain situations, example scenarios for uncertain situations
  + Decision making process and why it is an executive function?
  + General findings of neural correlates for decision making, role of PFC (a slight intro) (based on previous studies – broad and general findings)

## Neural correlates for decision making during exploratory behaviour

* + Exploitation/exploration dilemma as an example for simulating an uncertain situation.
  + Any decision-making circuits have been identified from population activity using LFP/fMRI signals from different regions of the brain? (Exploratory behaviour and decision making in Monkey and human – fMRI/Ephys)
  + How is it underexplored in rodent models? (Exploratory behaviour is seen but role of frontal cortex is debated).
  + What is already explained/ known from current literature? (Specific to rodents)
  + What is lacking in current literature?

## Role of Frontal cortex in decision making process in rodent models?

What is frontal cortex mean in general and how it is different in rodents (anatomy and layer physiology)? Why its role is still debatable? What are its major functions? Physiological reasoning and/or methodical reasoning for choosing it for this study?

## Why laminar recording and why CSD?

* To study layer physiology through LFP recording and read out layer specific activity within a cortical region (Max’s previous papers).
* CSD – reference free approach, increase spatial resolution
* Why layer-specific information is important to understand cortical circuit physiology better?

## What is my broad research question? (Objective – Tracing the frontal cortical activity patterns of decision-making process during exploitation-exploration dilemma)

* Behavioural correlates for exploitation and exploration behaviour.
* Focusing on observing the activity patterns of overall frontal activity just before the animal decides to explore (comparable to previous frontal cortex studies in humans and macaques).
* Investigating the existence of layer-specific activity patterns during the aforementioned decision-making period.

# **Discussion**

## Summary of the whole study including the obtained results

## Stimulus bound and inference bound decision making (Behaviour results)

* + Explain what is stimulus bound and inference bound decision making. From both experimental data (Lottem second paper) and theoretical models. Relate this to our animal behaviour and why you think it is showing some sort inference-based decision making (optimal behaviour?)

## Evidence accumulation and decision making

* + Discuss about evidence accumulation models in decision making and how it is reflected in your study.
  + How the ramping of frontal activity is seen in literature (Human and monkey fMRI results).
  + Introduce the idea of change in expectation values and explain the U-shaped curve observed in our study

## Layer specific processing plays a decisive role?

* + Link with the studies which show layer dependent processing and expectation alteration (Dopamine studies that Max mentioned, Auditory cortex/VTA studies)
  + The effect of reward on decision making
  + Say why you expected to see supra and infra to explore and exploit situations.
  + Explain the layer specific results and how it aligns with your expectations and what could it imply?

## Limitations of the current study?

* + What are the main limitations in this study? (Think!)

## Future directions

* + Reinforcement learning based modelling to study how the optimal behaviour emerges from a trial-by-trial perspective.
  + Time frequency analysis - look for increase in frontal theta activity just before the decision to explore (idea is that mid-frontal theta activity overcomes the Pavlovian bias (exploitation) (Cavanagh et al., 2012))
  + Optogenetic intervention to establish a causal connection between frontal layers and the decision-making process
  + Comparative human studies and identifying layer specific involvement from fMRI?

# **Conclusions and perspectives**