



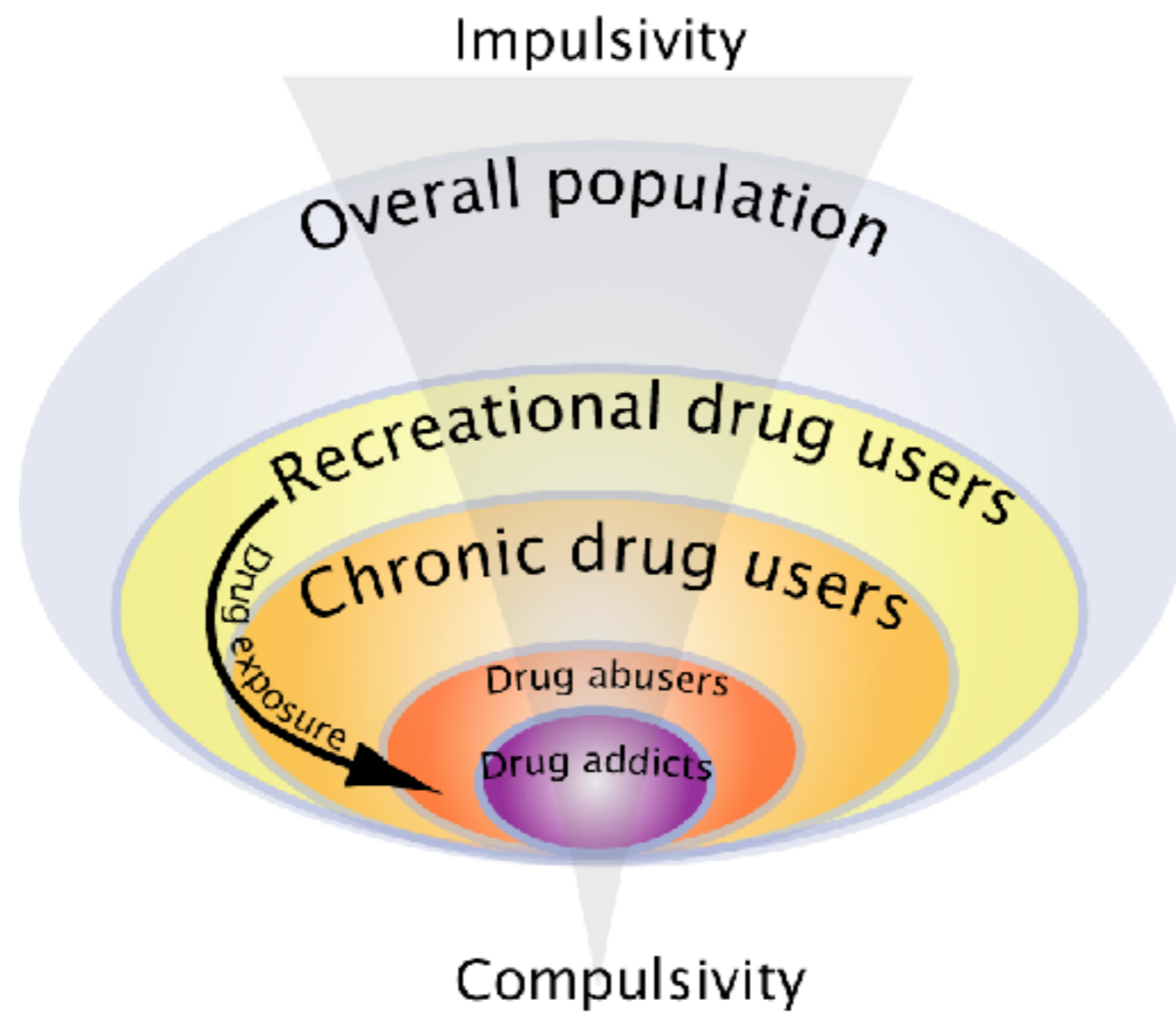
UNIVERSITY OF
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Addiction: from impulse to compulsion

David BELIN

Department of Psychology, University of Cambridge



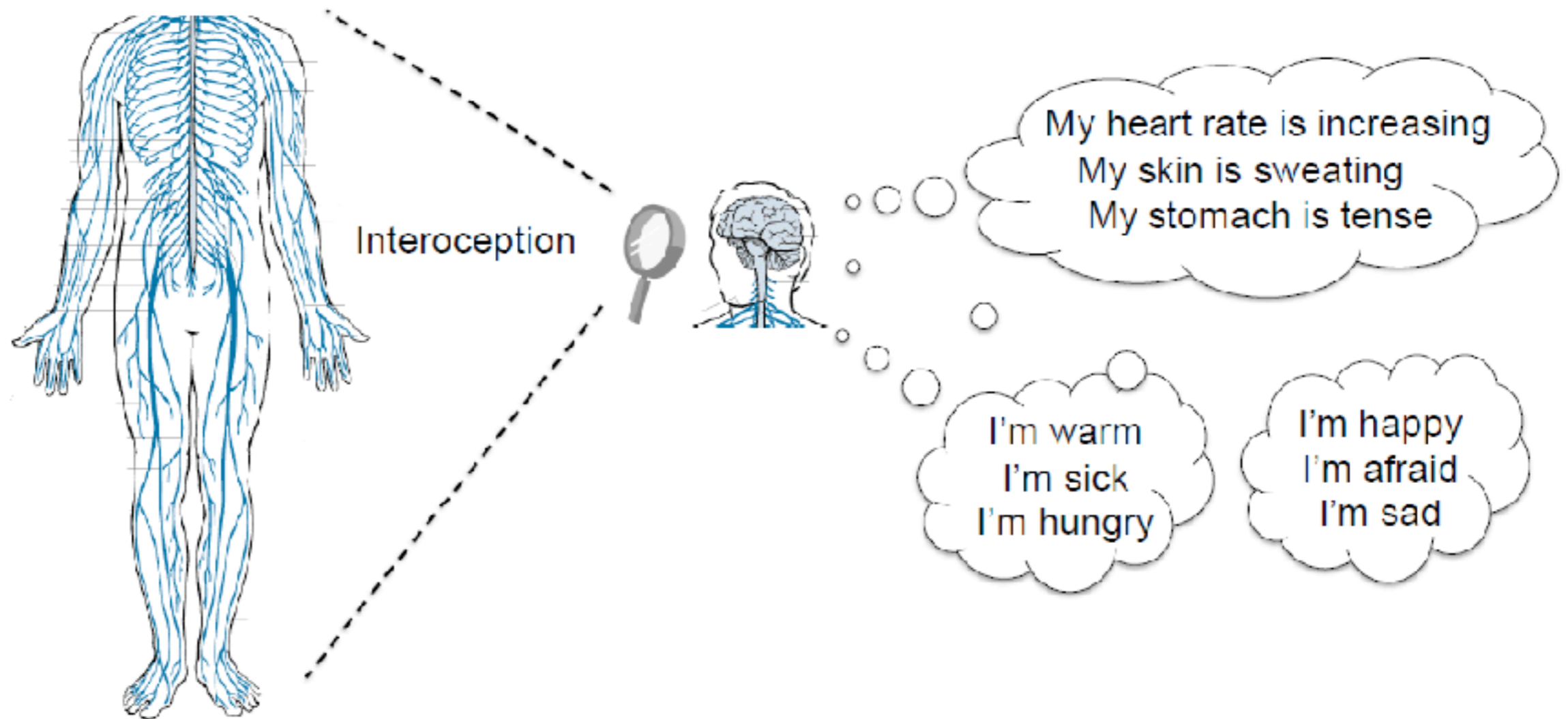
What is an impulse and how can we understand impulse control disorders?



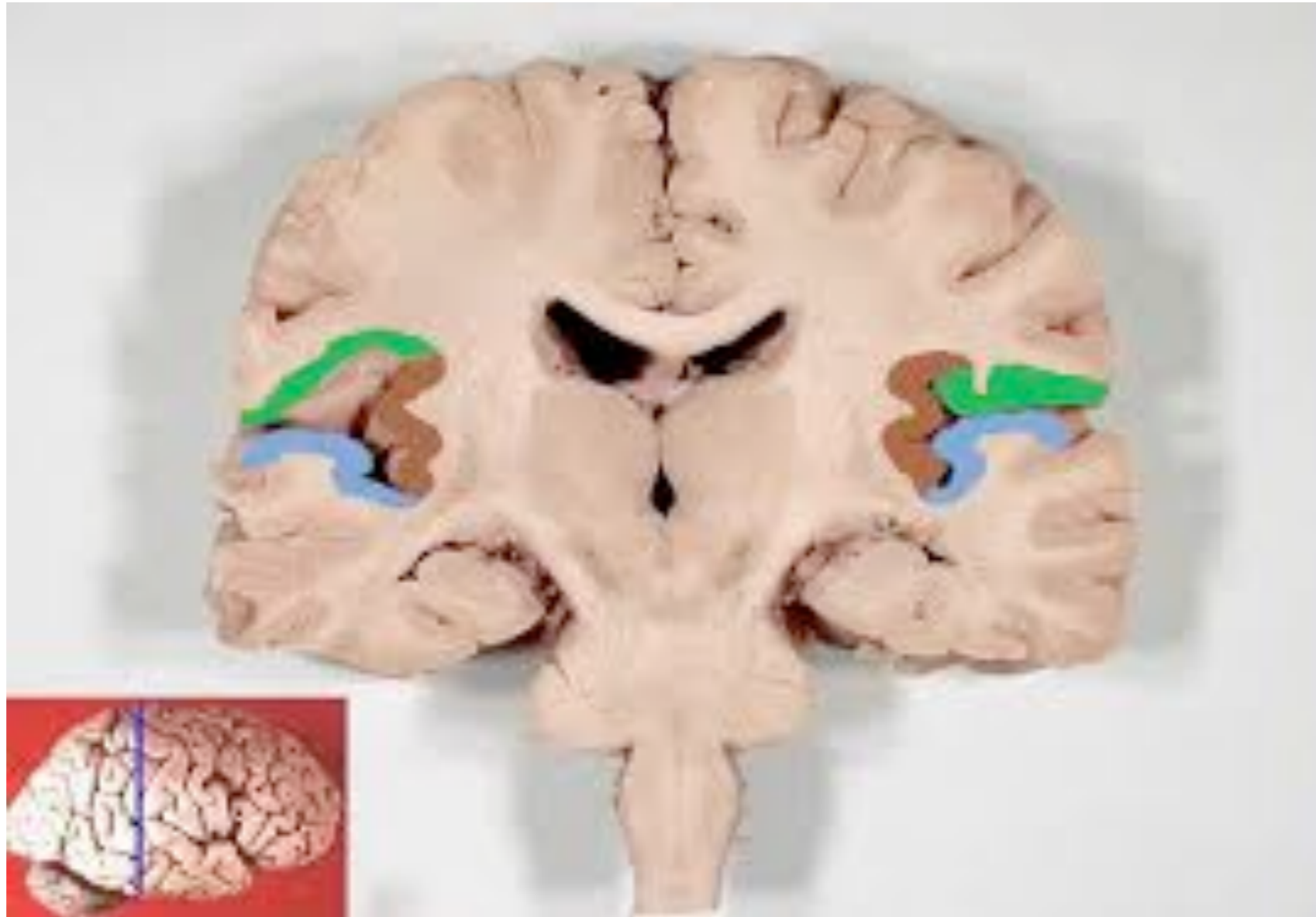
The nature of the impulse

The strength of executive control

What is an impulse and how can we understand impulse control disorders?



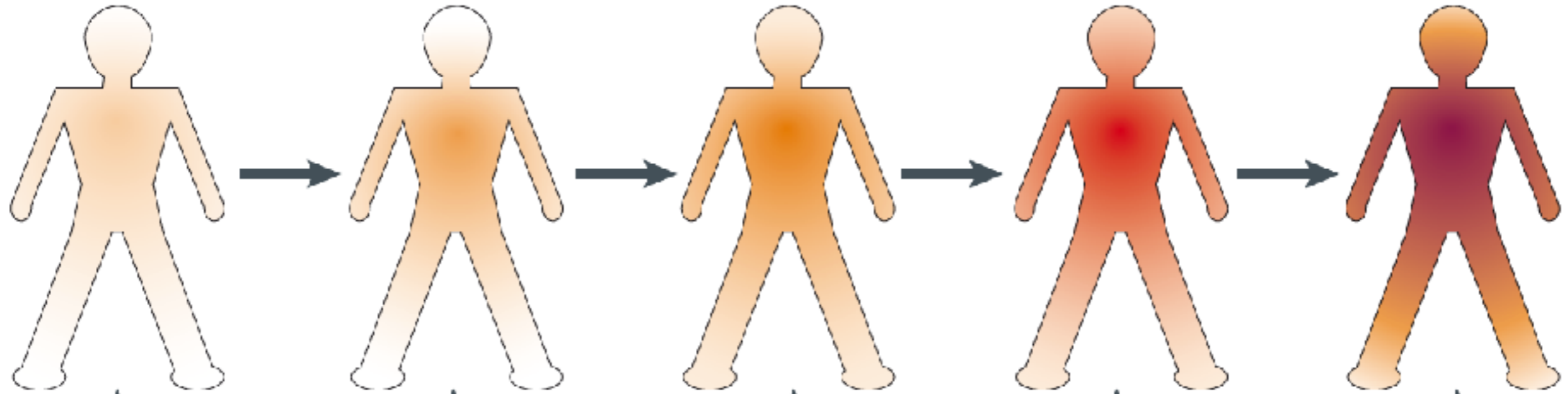
The Insula



The Insula

Posterior insula

Anterior insula



Primary
interoceptive
representation

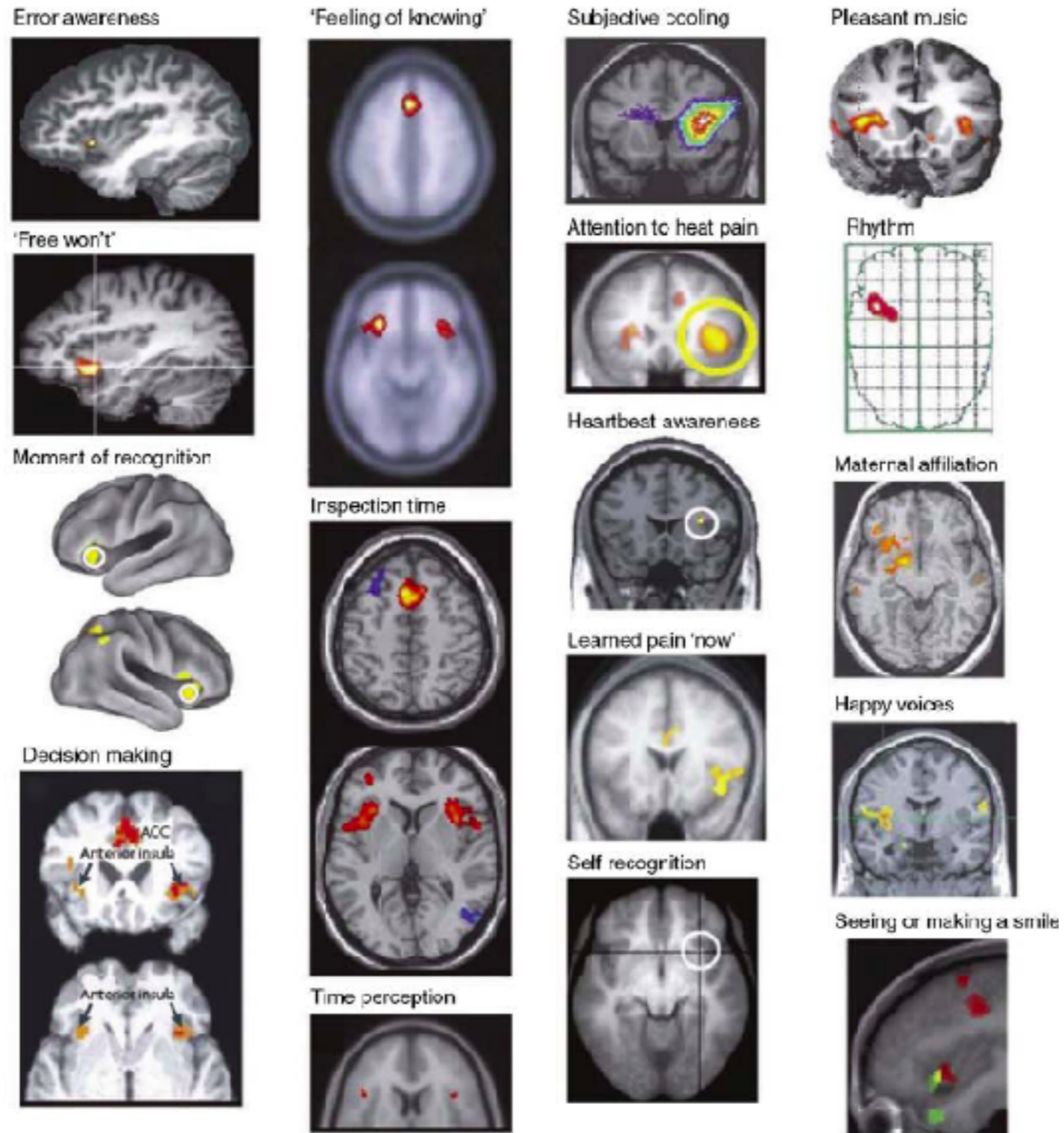
Homeostatic
motor function
(hypothalamus
and amygdala)

Environmental
conditions
(entorhinal and
temporal poles)

Hedonic conditions
(nucleus accumbens,
and orbitofrontal
cortex)

Motivational, social
and cognitive
conditions (ACC,
VMPFC and DLPFC)

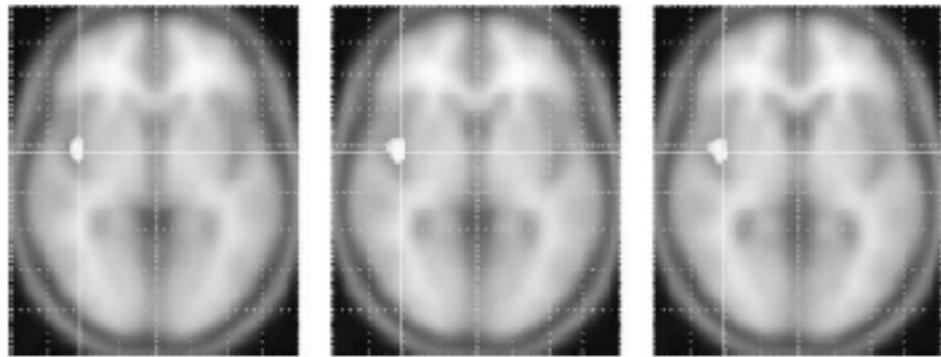
The AI: from insight to behavioural control



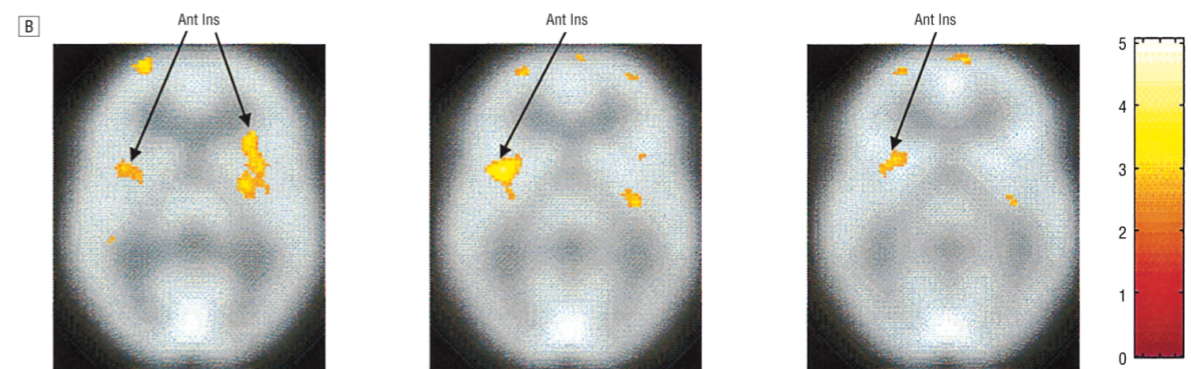
The AI: from insight to behavioural control

Insula neurobiological substrate of obsessions:

OCD



Craving in addiction



Interest of preclinical models: prospective longitudinal studies



Genes



Environment



Personality

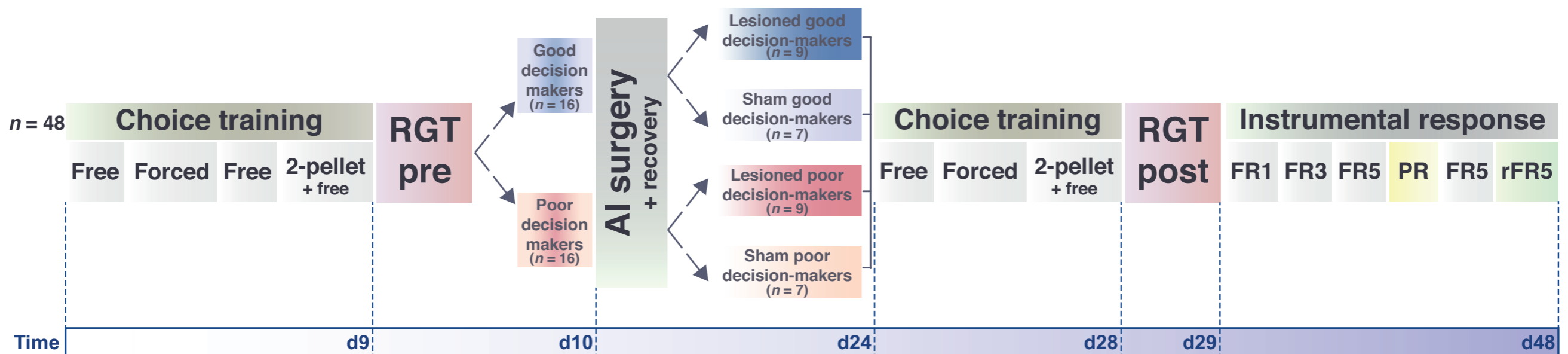
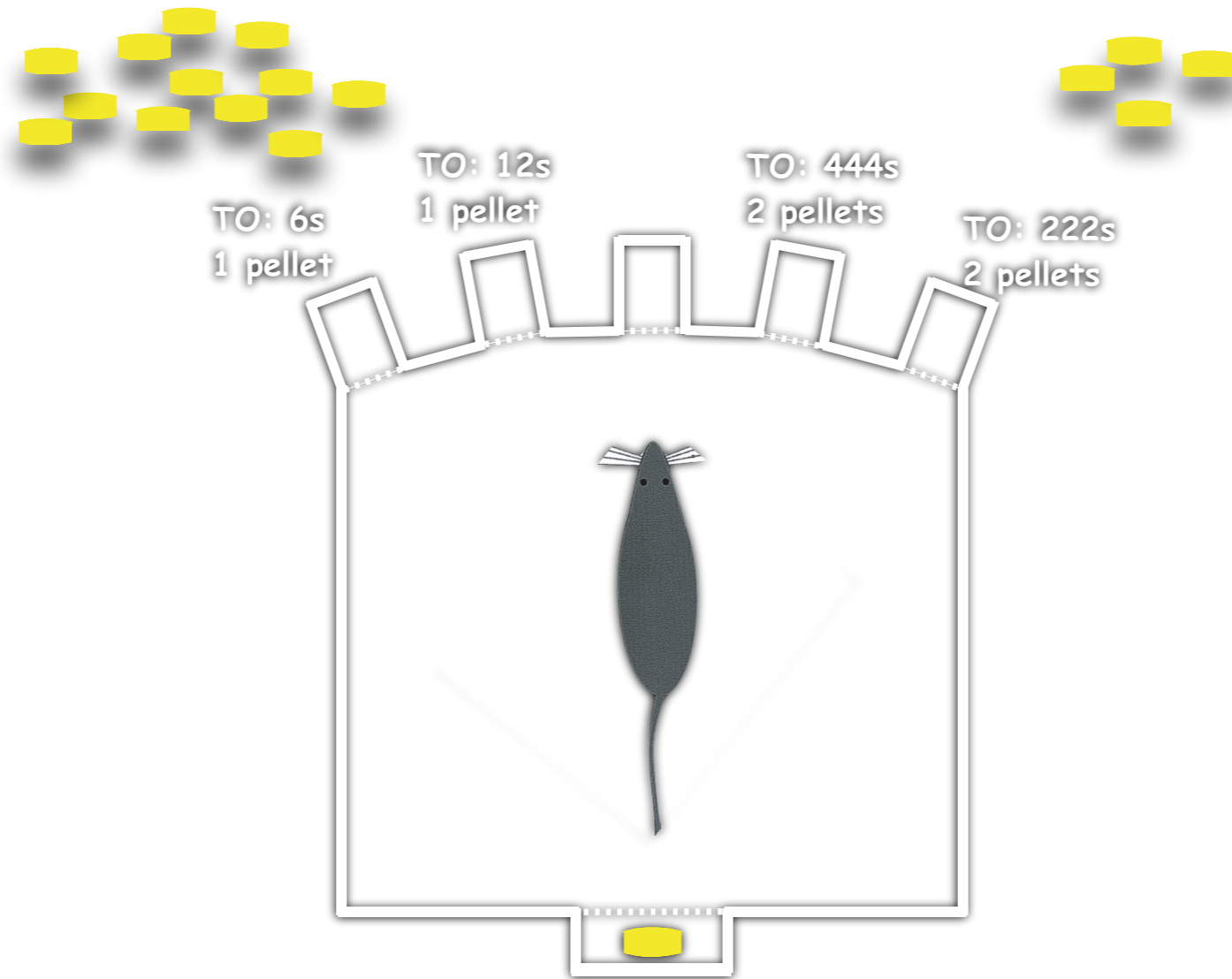
Vulnerability

Medical care

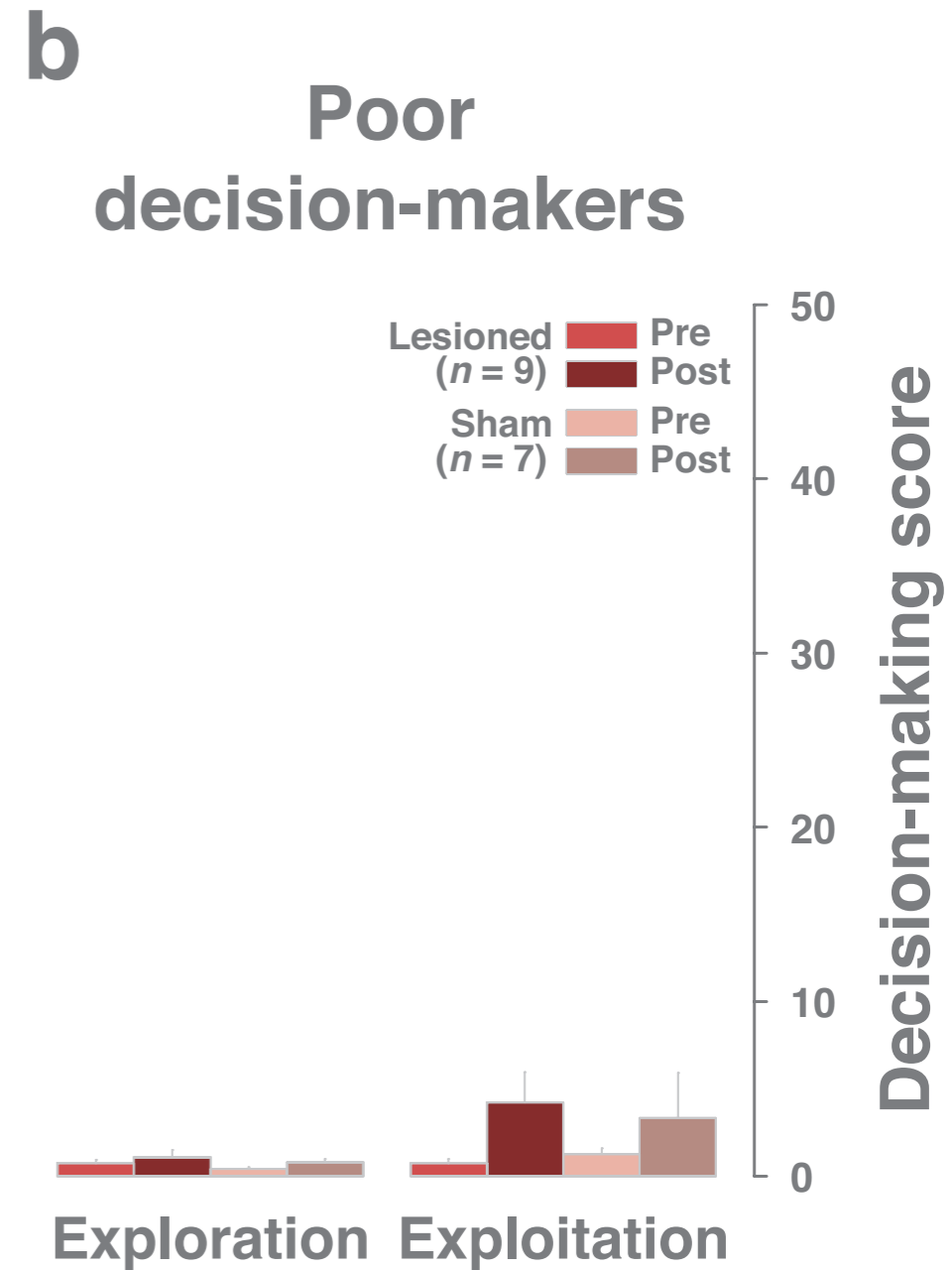
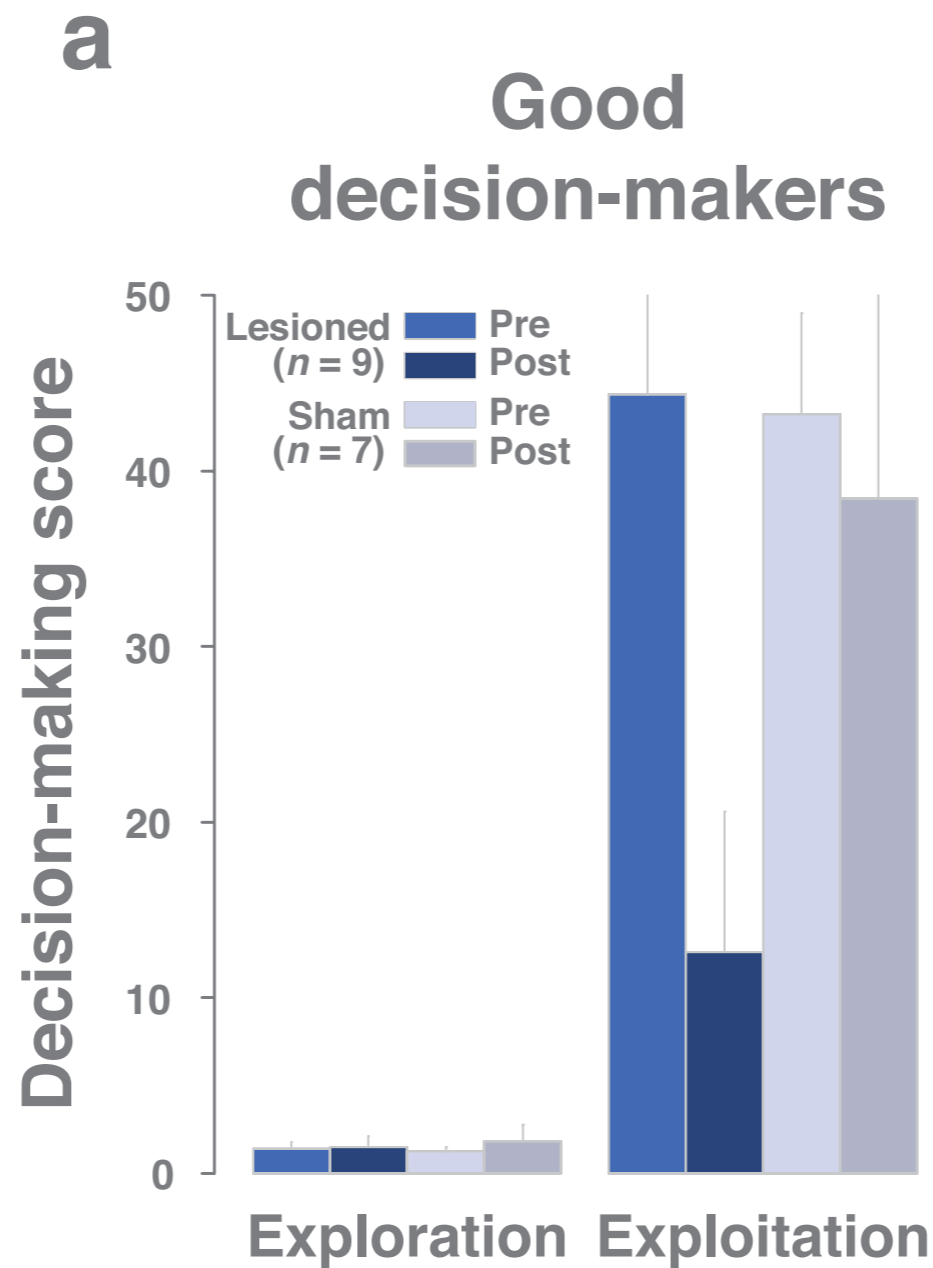
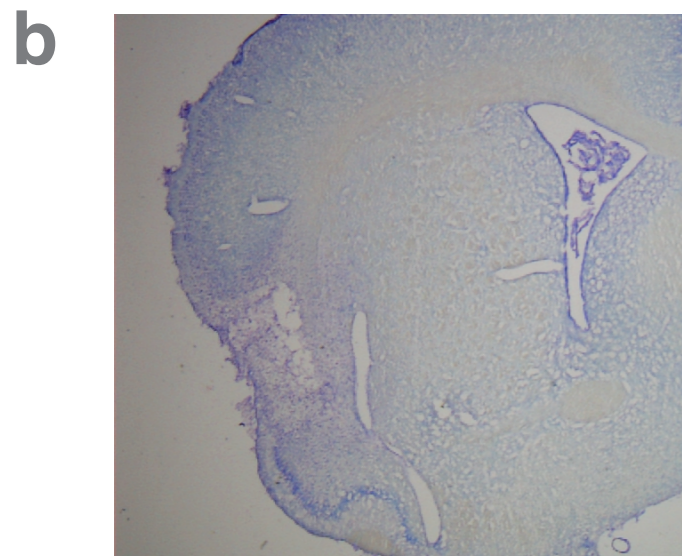
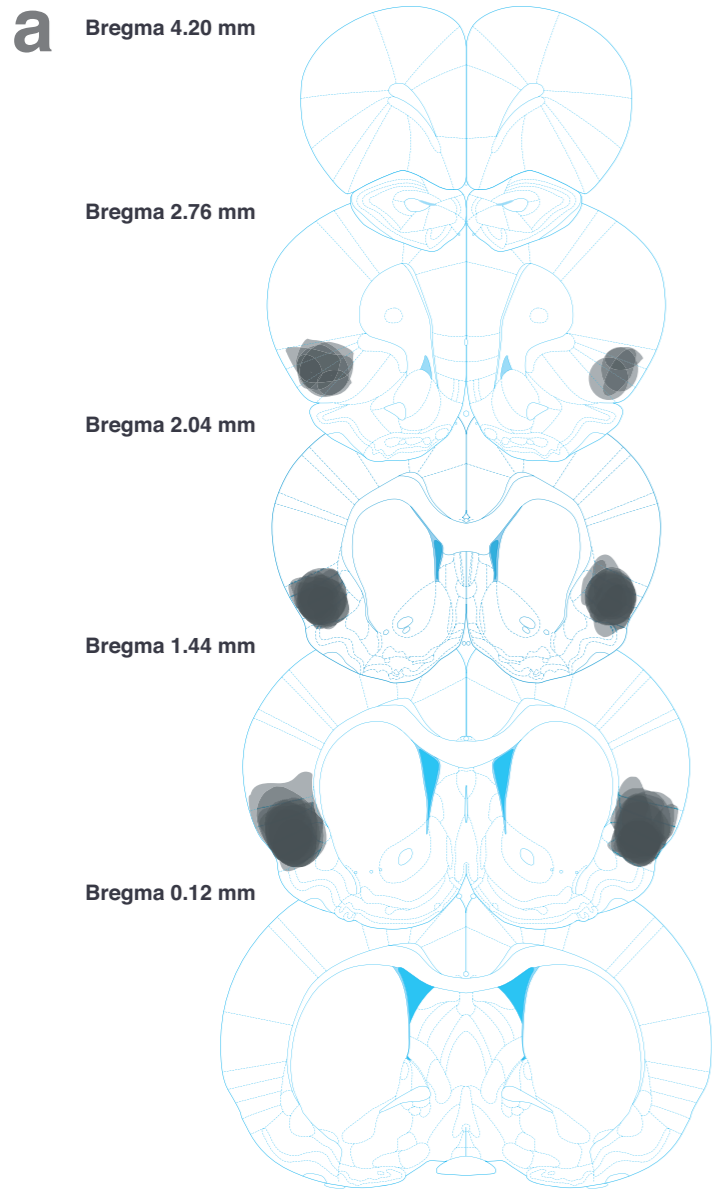


Pathology

Maximisation of decision-making requires the AI

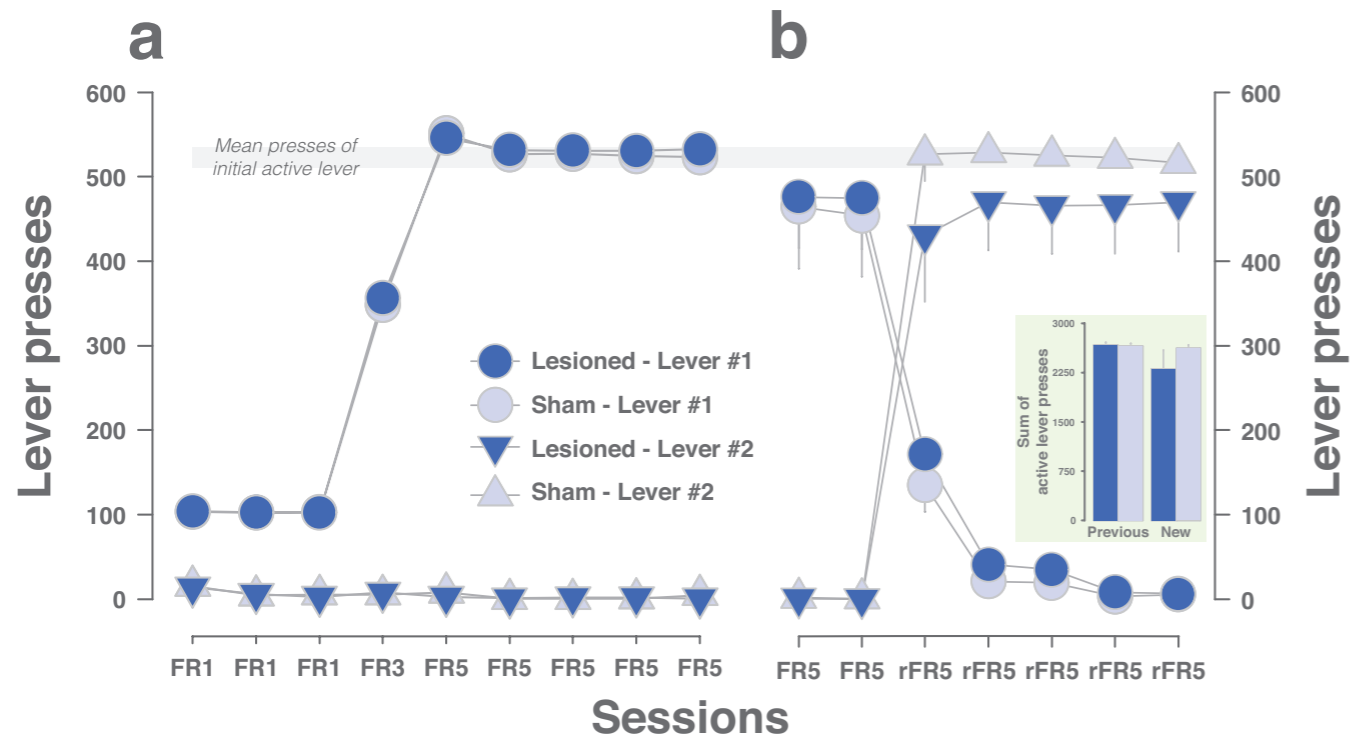


Maximisation of decision-making requires the AI in rats

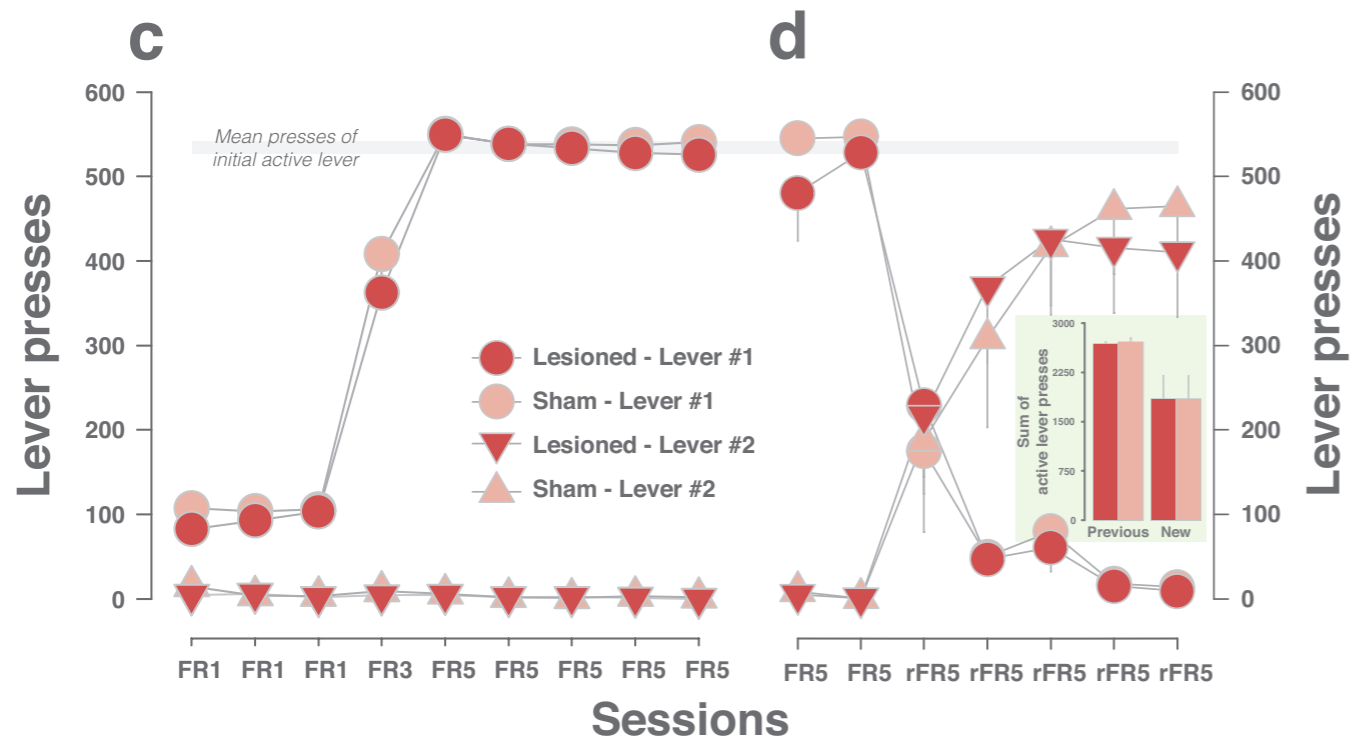


Maximisation of decision-making requires the AI in rats

Good decision-makers



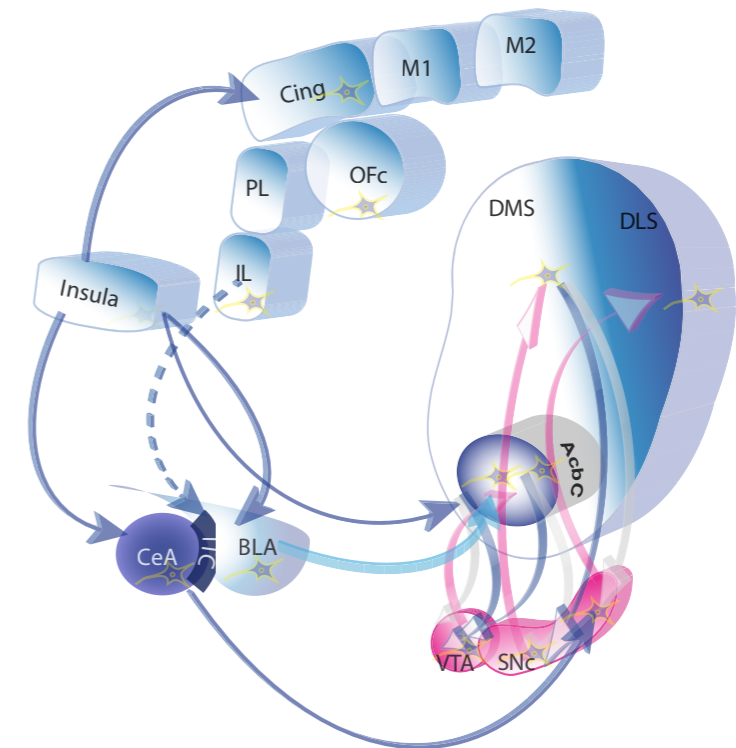
Poor decision-makers



The insula and impulses

Does the insula contribute to impulse control?

Does interception/the insula contribute to the nature of the impulse?



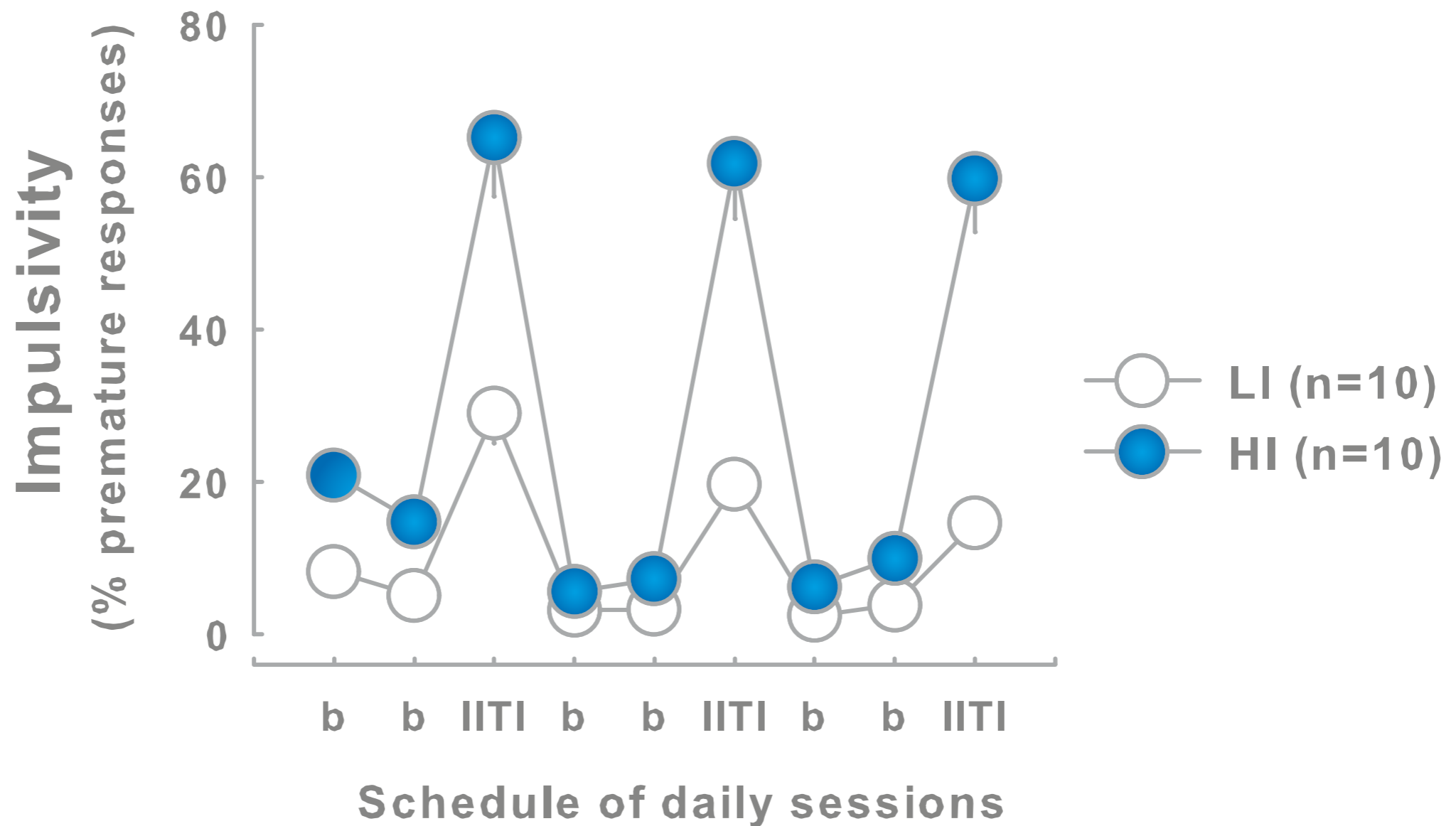
Inter-individual differences in impulse control: example of waiting impulsivity

How do we measure impulsivity?
5-choice serial reaction time task



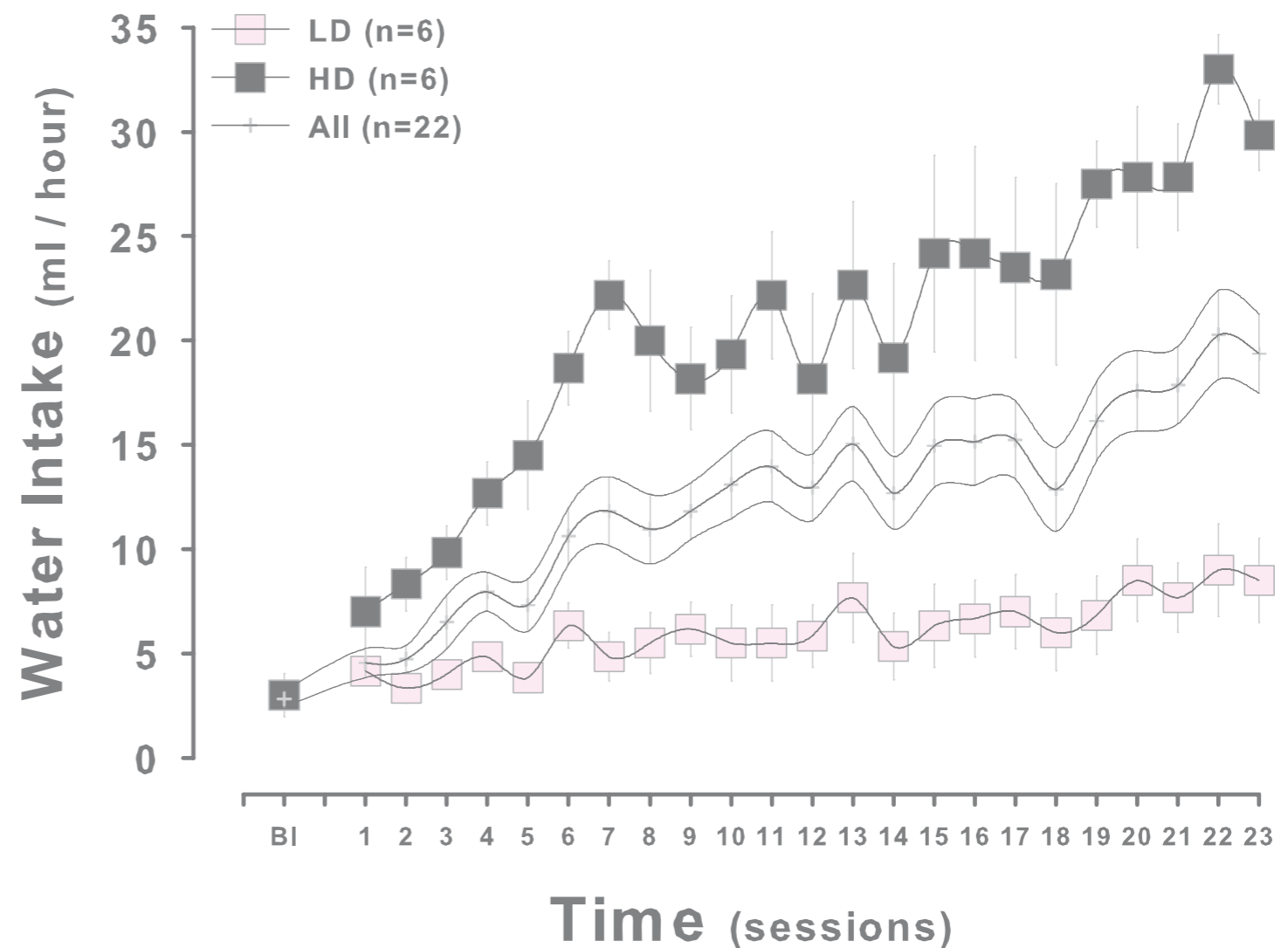
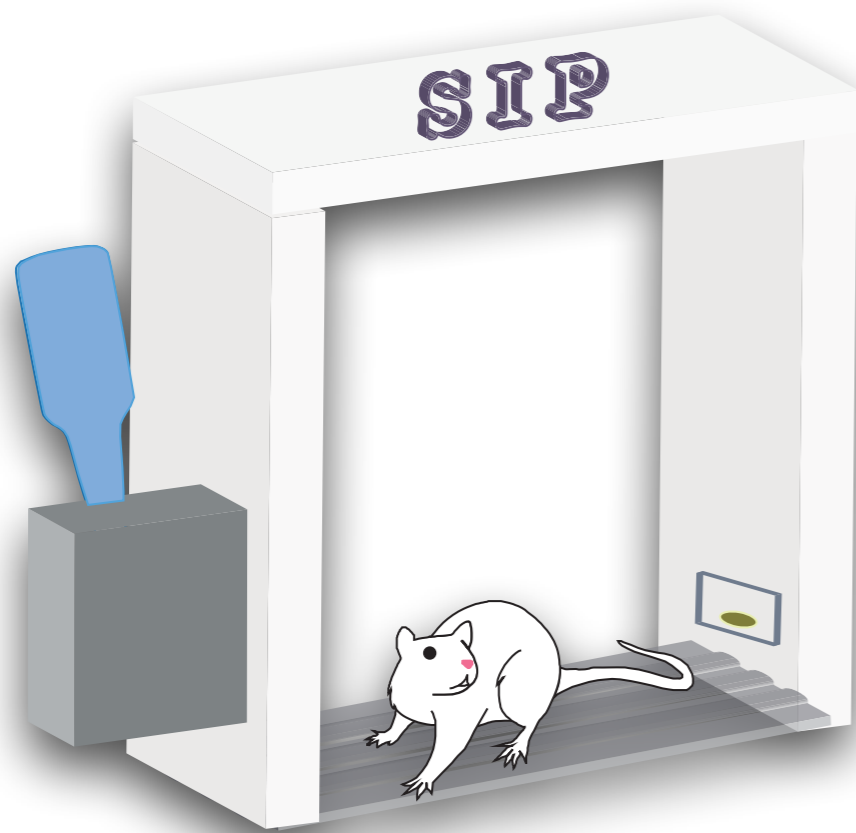
Inter-individual differences in impulse control: example of waiting impulsivity

How do we measure impulsivity?
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High impulsivity trait is an endophenotype of vulnerability to compulsivity

Example of drug OCD-like behaviour schedule-induced polydipsia



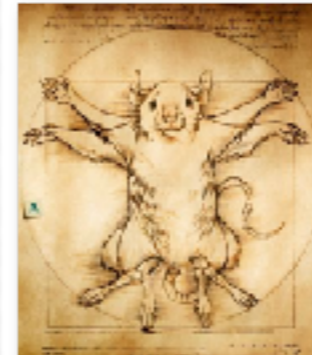
High impulsivity trait is an endophenotype of vulnerability to compulsivity

Example of drug OCD-like behaviour schedule-induced polydipsia



OCD Psychopathology

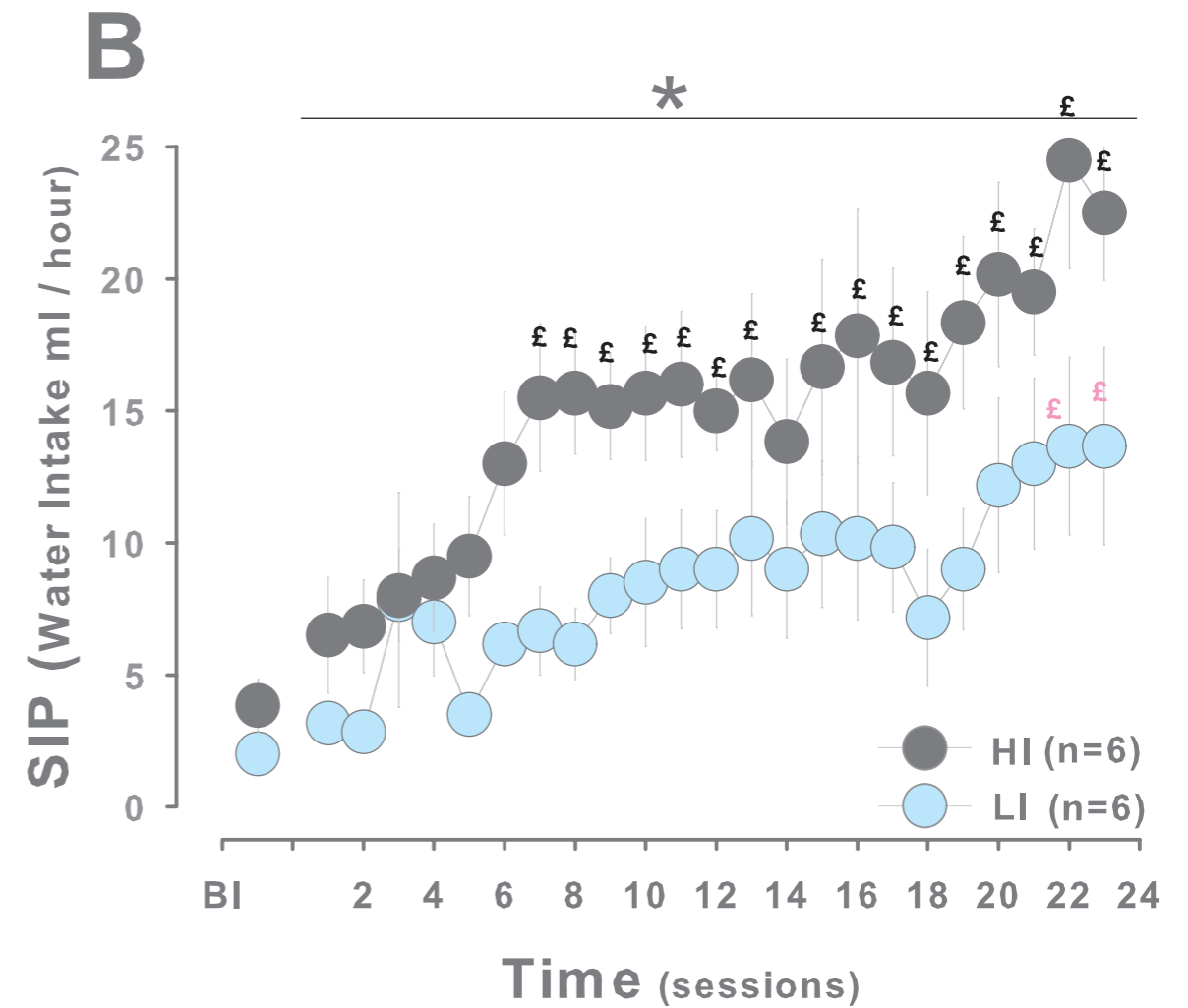
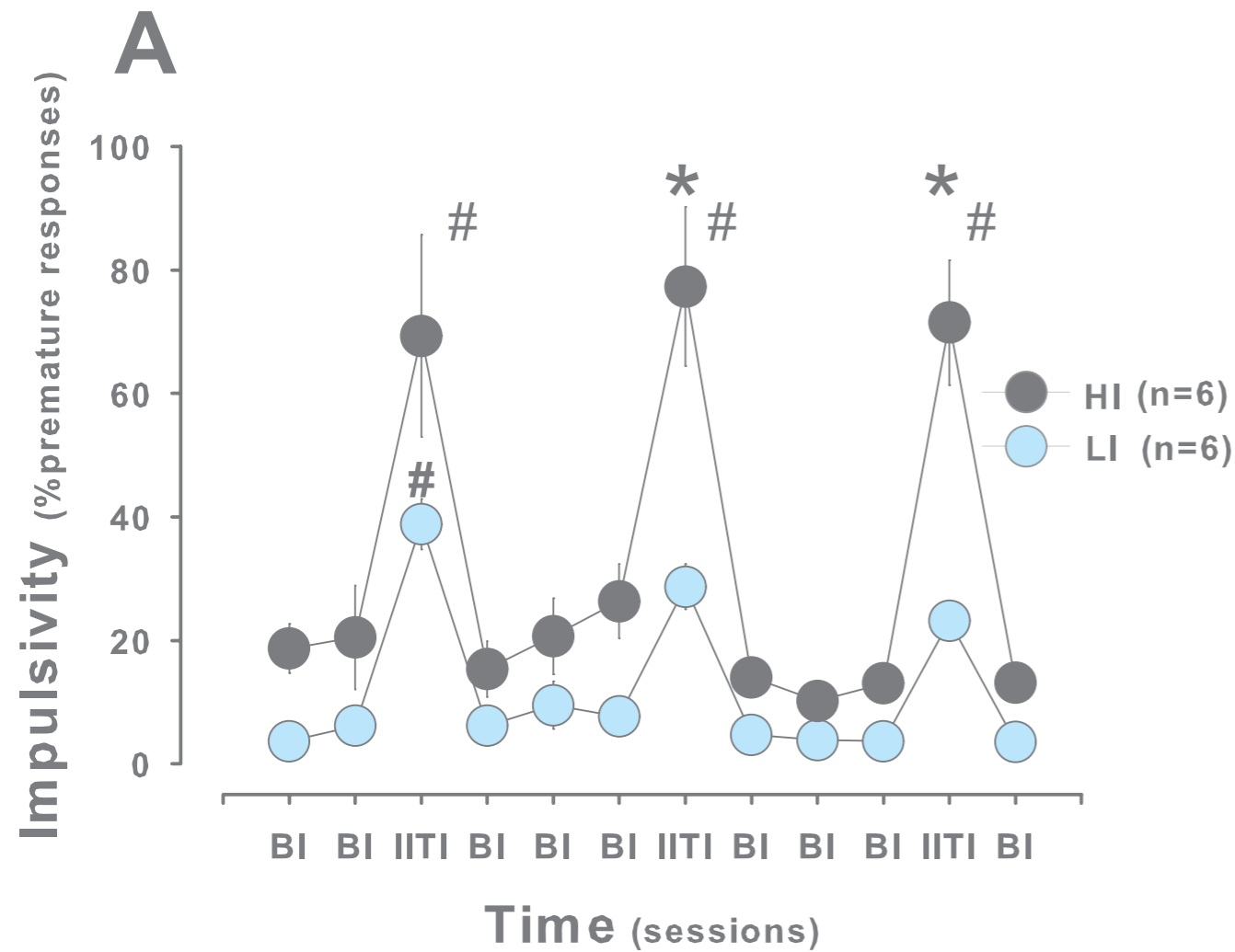
- Repetitive behaviours
- Aimed at reducing distress or preventing some dreaded situation
- Excessive or unreasonable
- Interfering with activities
- Responsive to SSRI



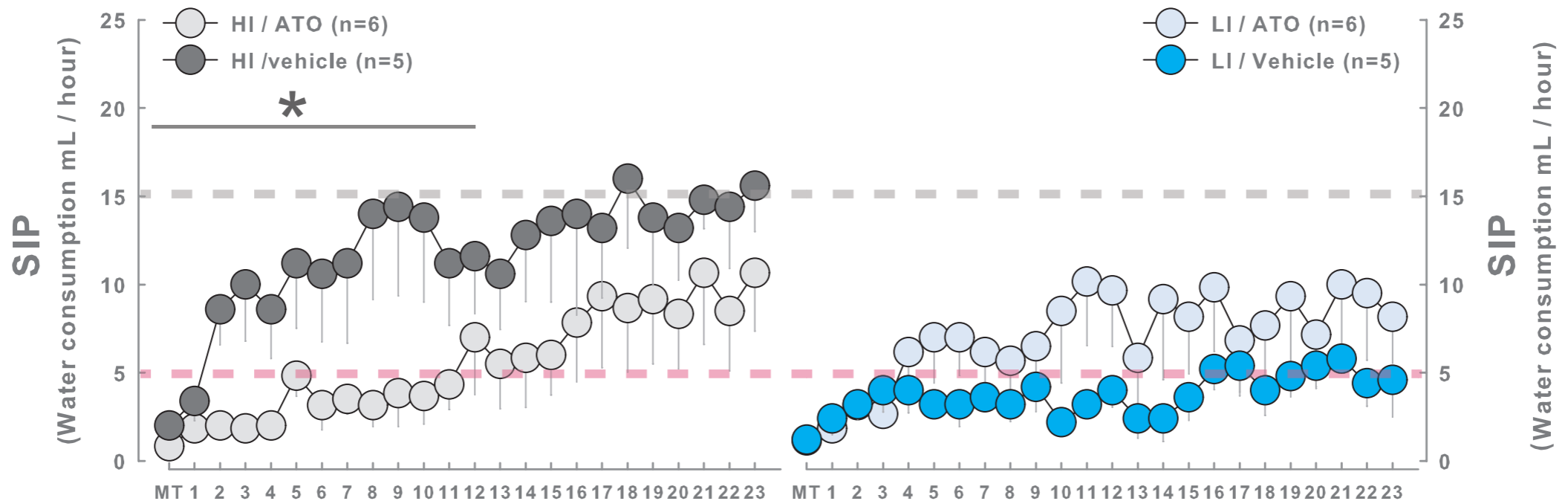
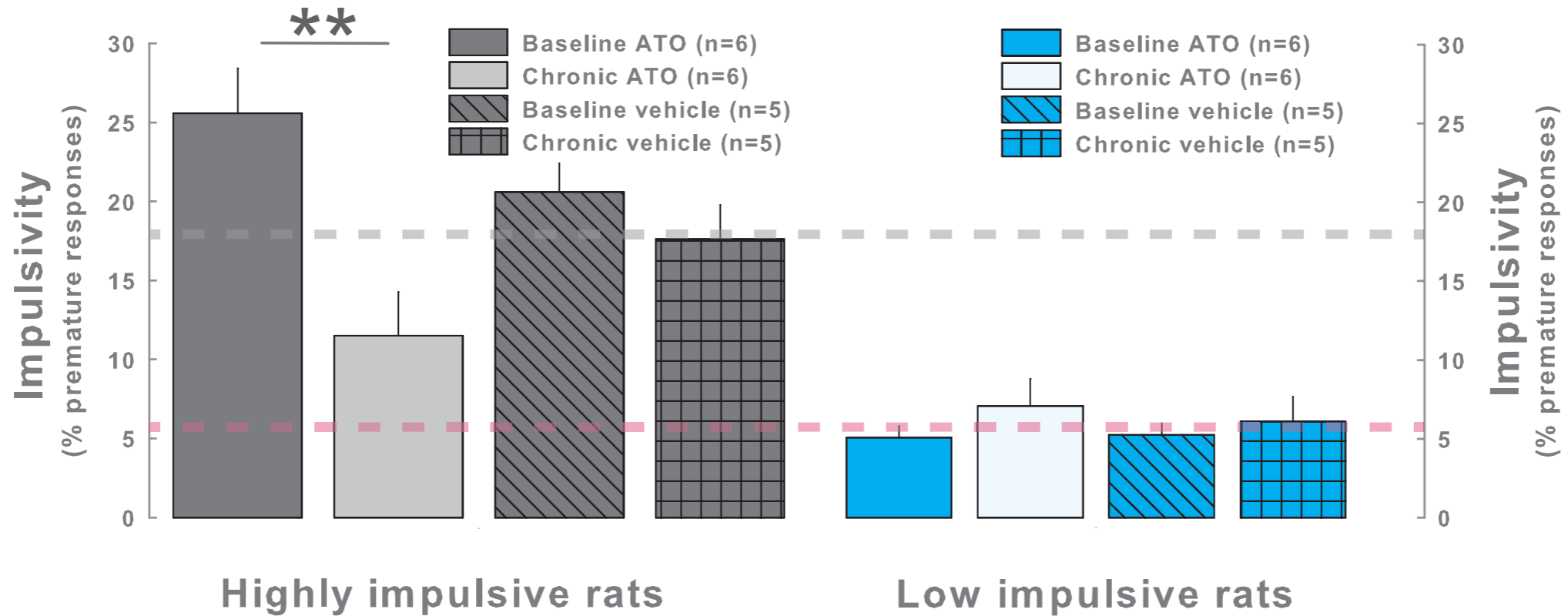
SIP Animal model

- Repetitive adjunctive drinking behaviour
- Anxiolytic behaviour
- Excessive behaviour, unrelated to thirst
- Rigid and maladaptive
- Sensitive to SSRI

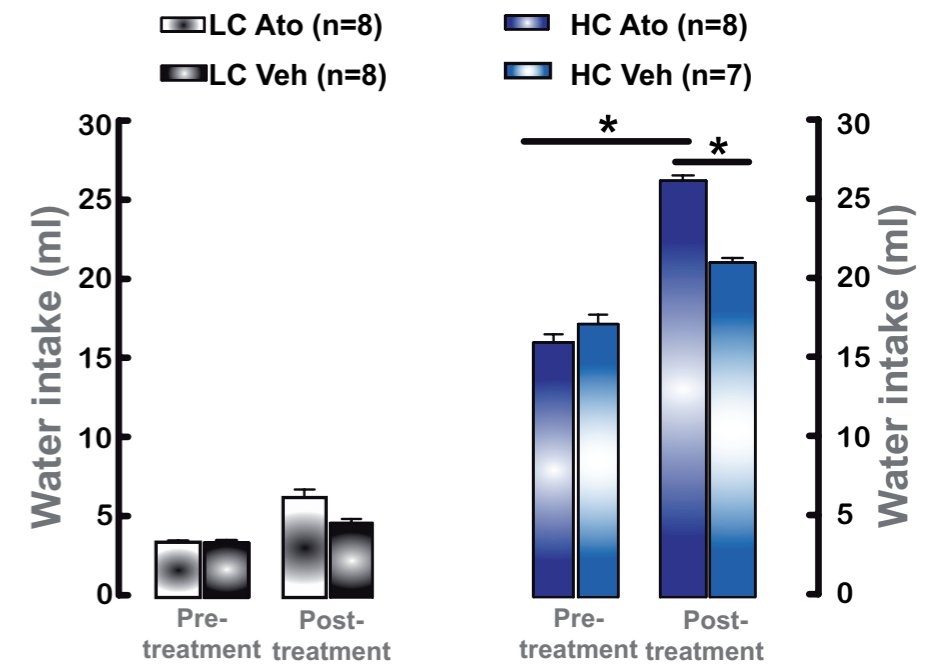
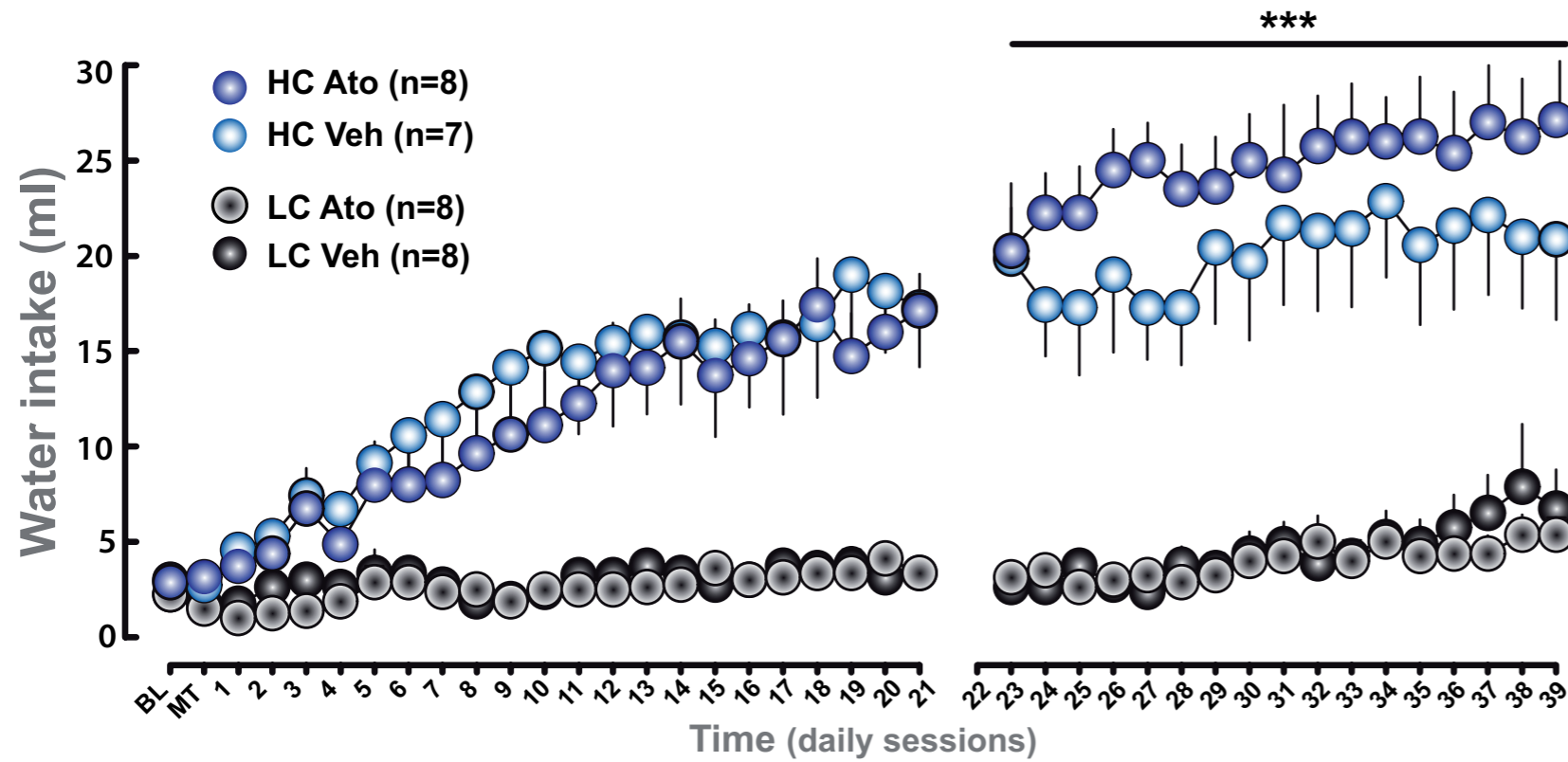
High impulsivity trait is an endophenotype of vulnerability to compulsivity



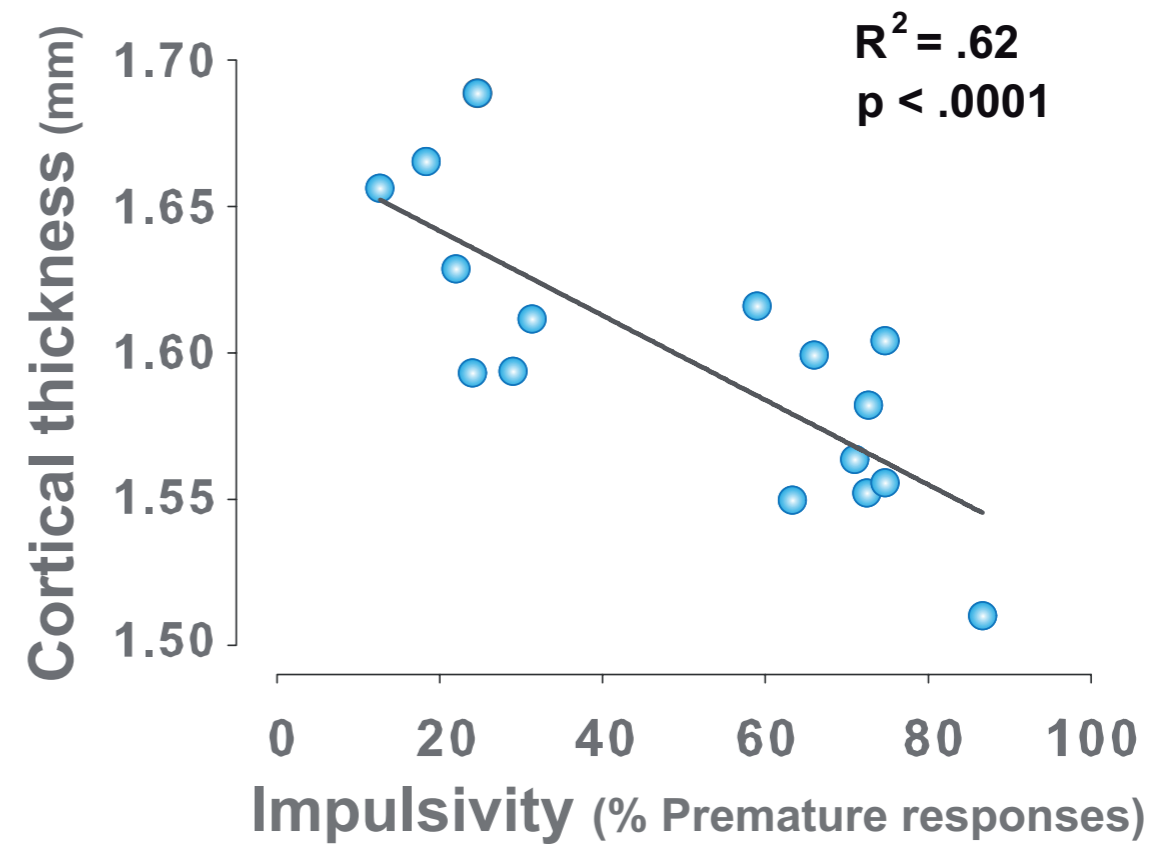
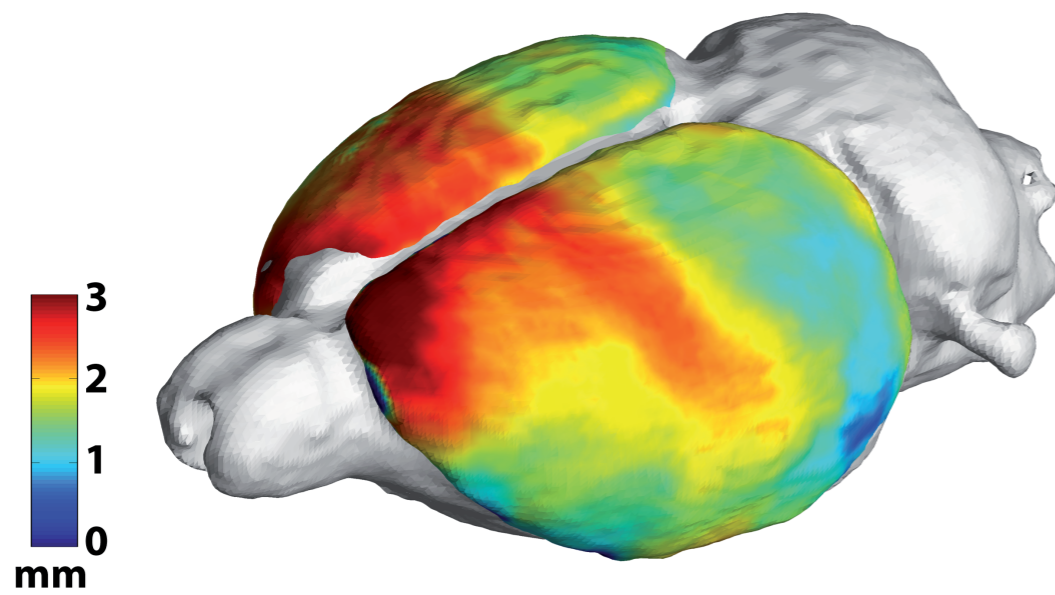
High impulsivity and compulsivity: NAergic mechanisms



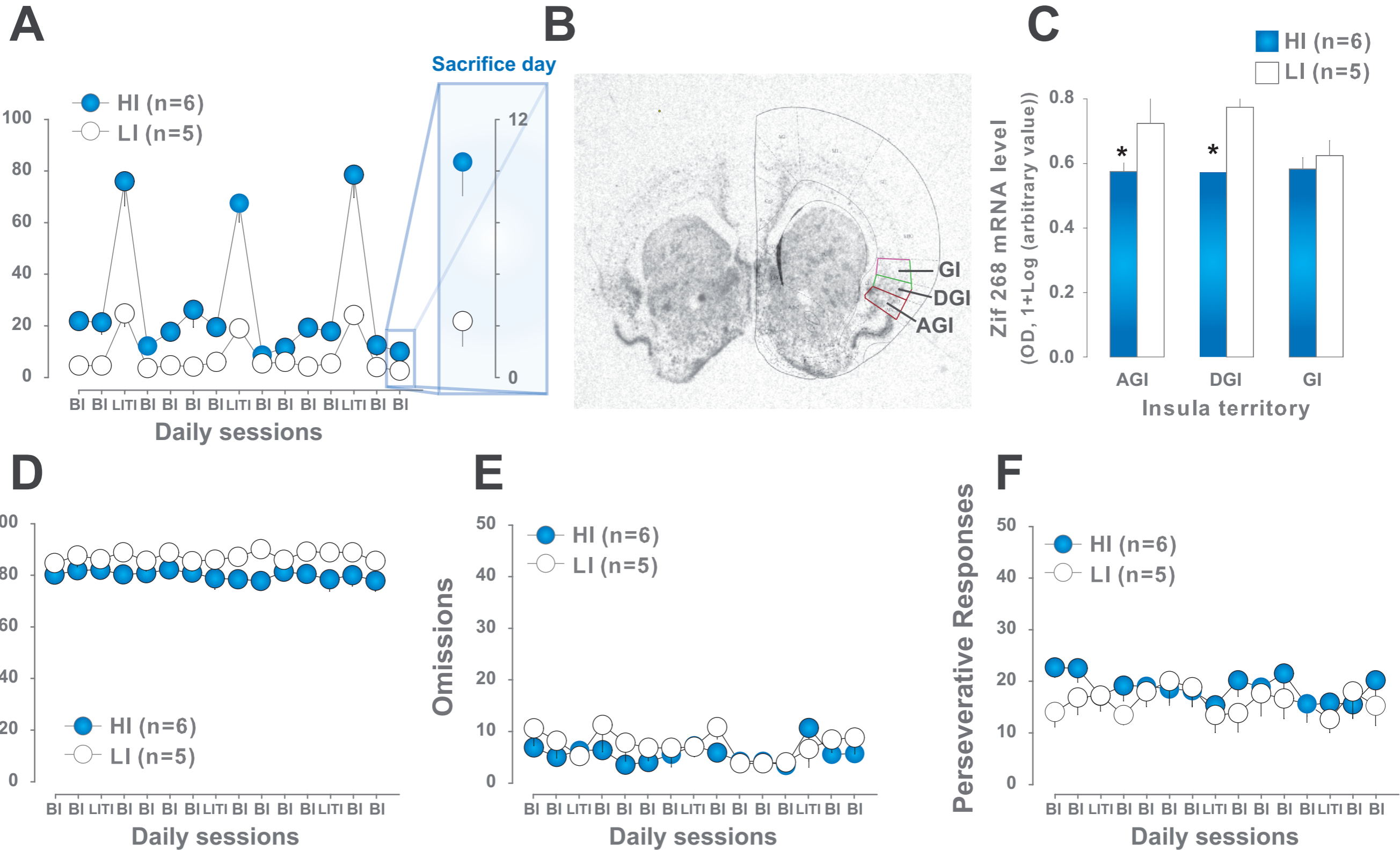
High impulsivity and compulsivity: NAergic mechanisms



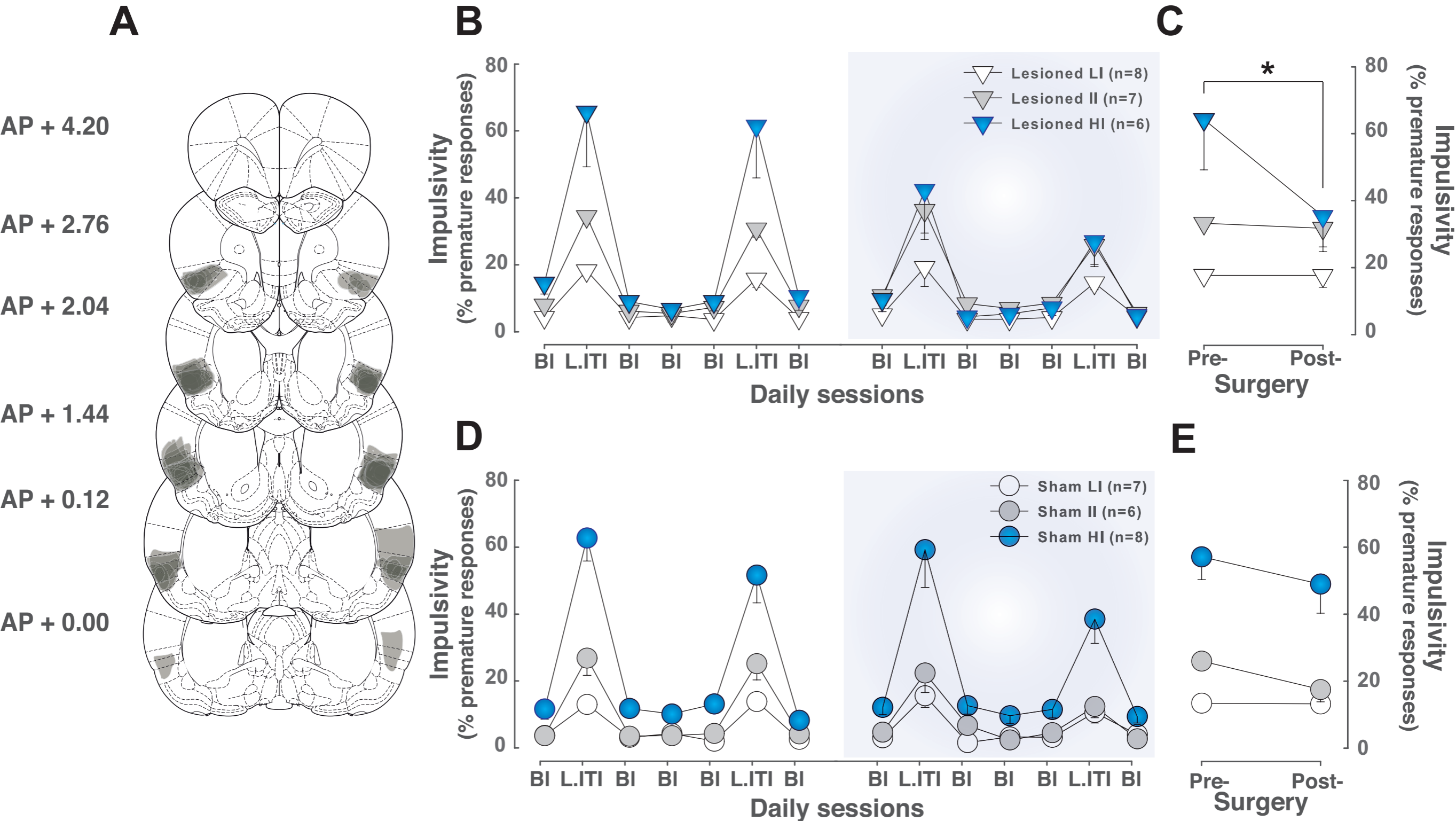
Impulsivity and the anterior insular cortex



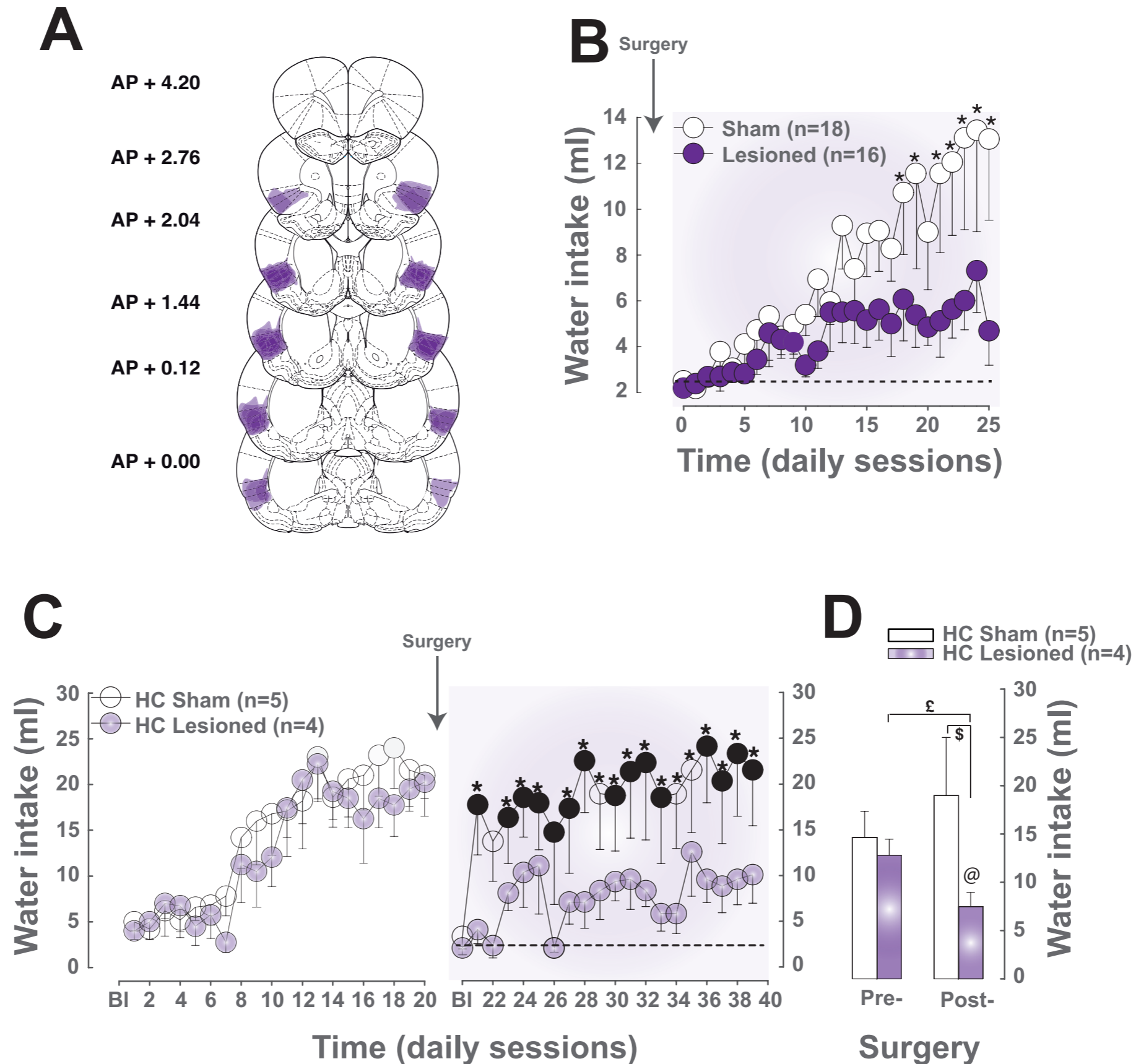
Impulsivity and the anterior insular cortex



Impulsivity and the anterior insular cortex



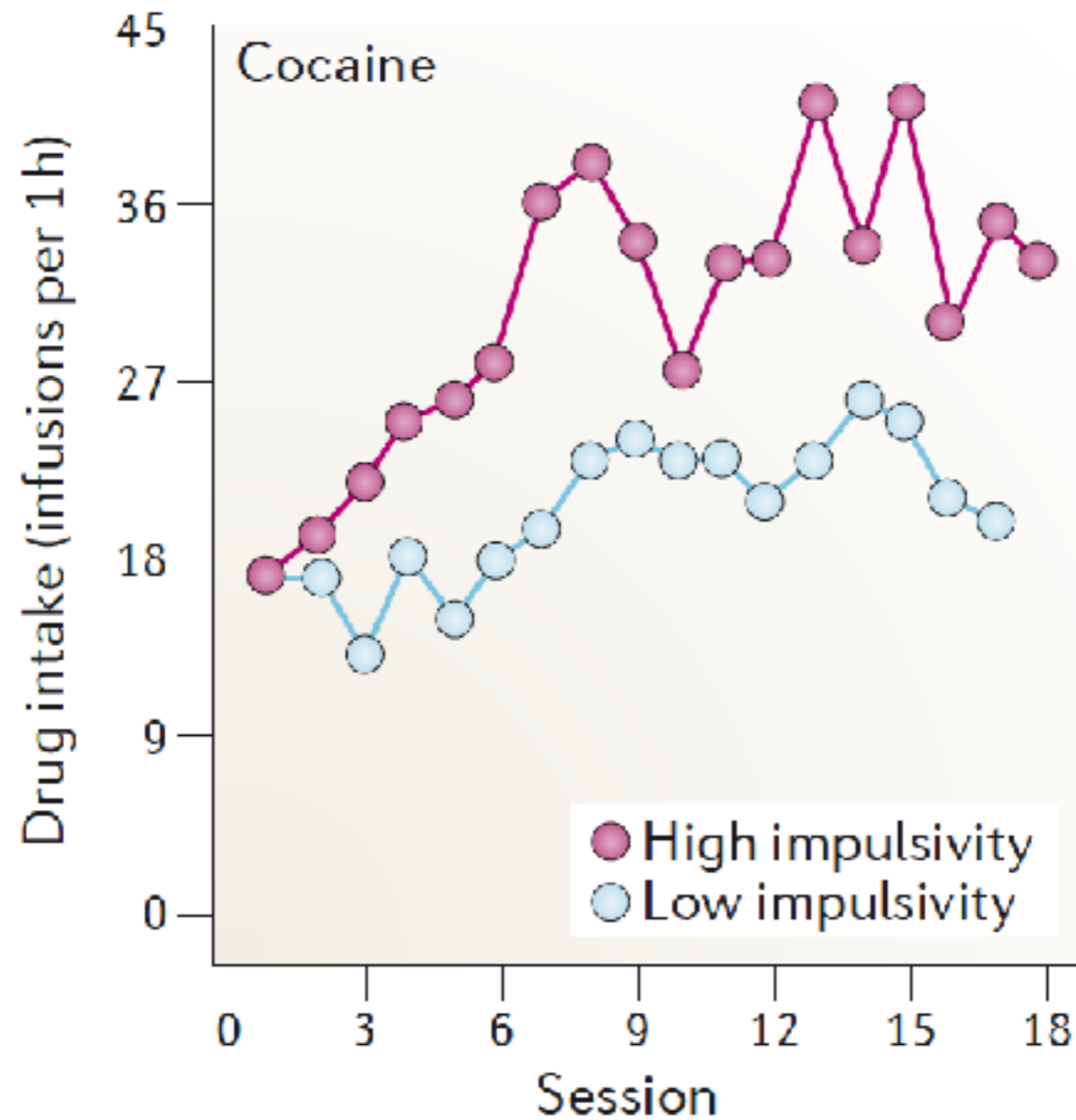
Compulsivity and the anterior insular cortex



Impulsivity → **quantitative nature of interoceptive cues**

Compulsivity → **qualitative nature of interoceptive cues**

Towards an evidence? AI and escalation of cocaine intake

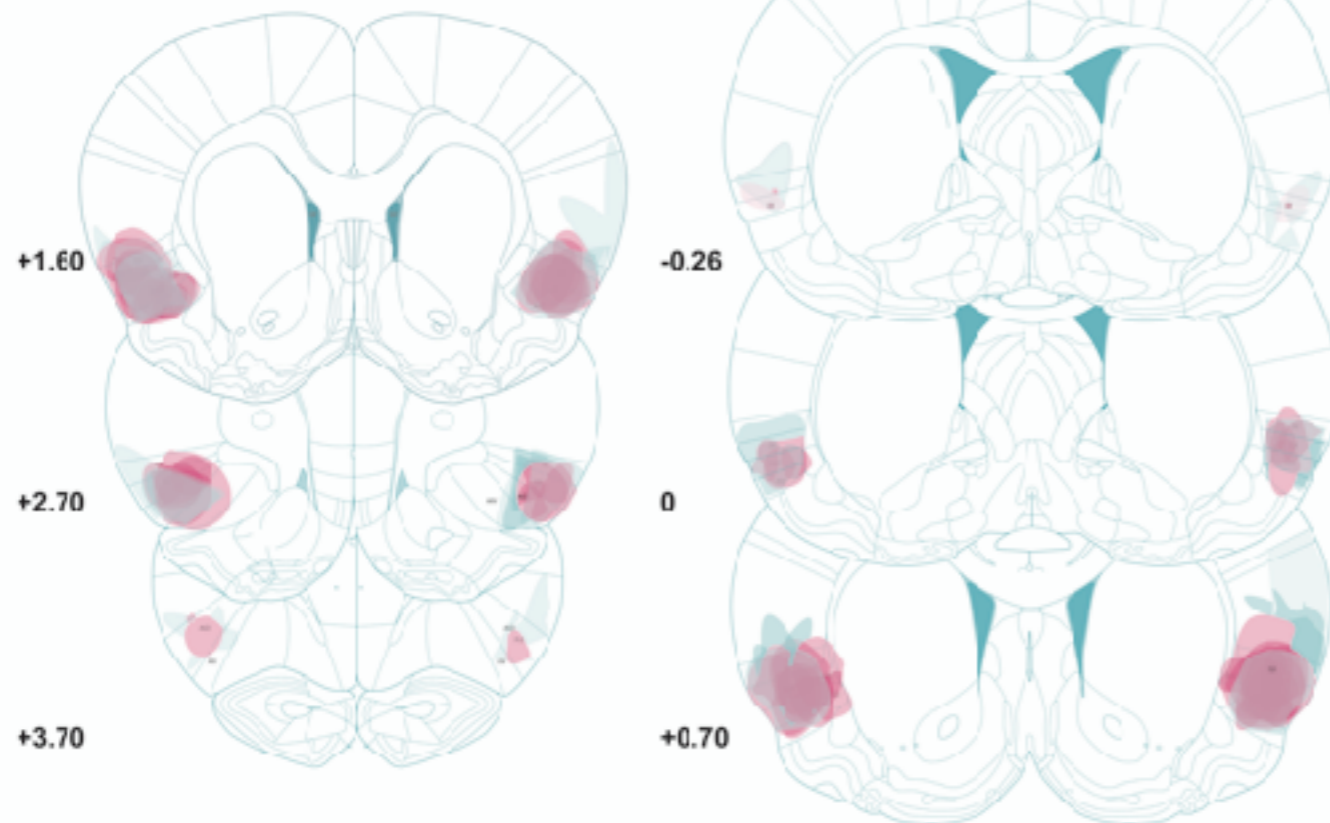


Dalley et al., Science 2007

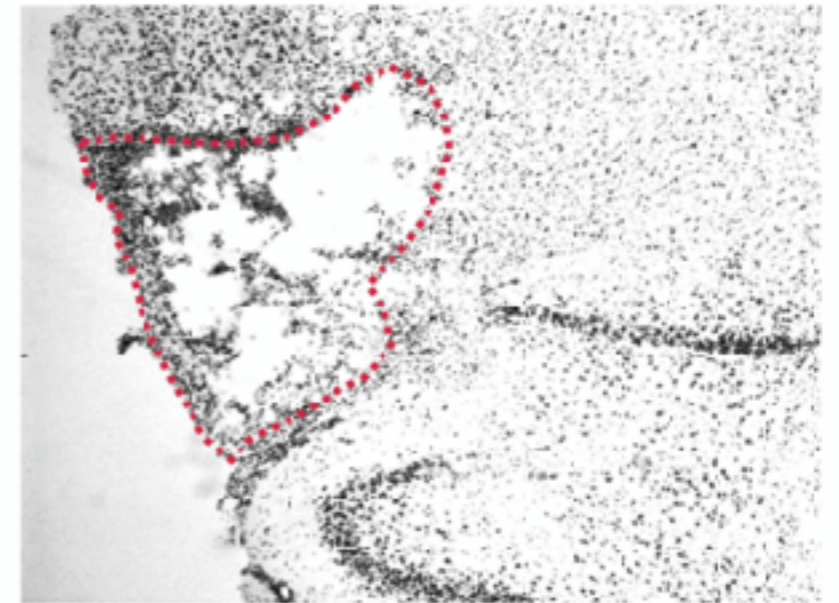
Badiani, Belin et al., Nat. Rev. Neurosci. 2011

Towards an evidence? AI and escalation of cocaine intake

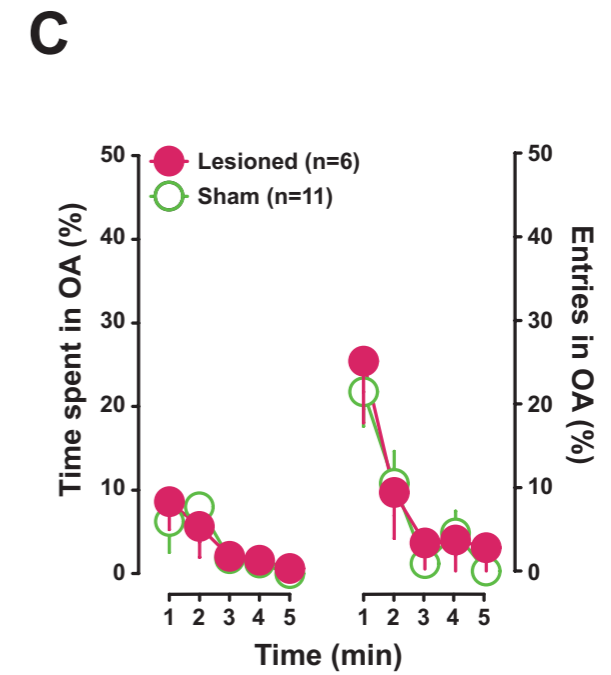
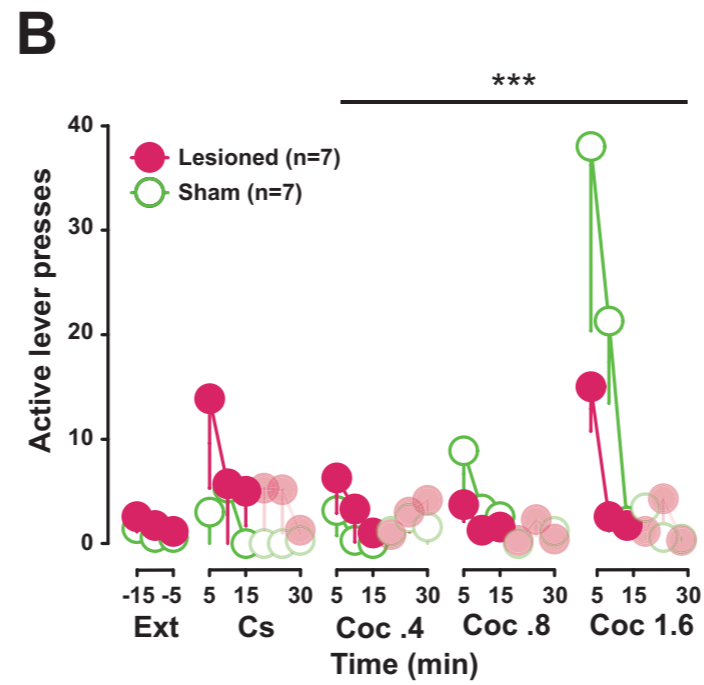
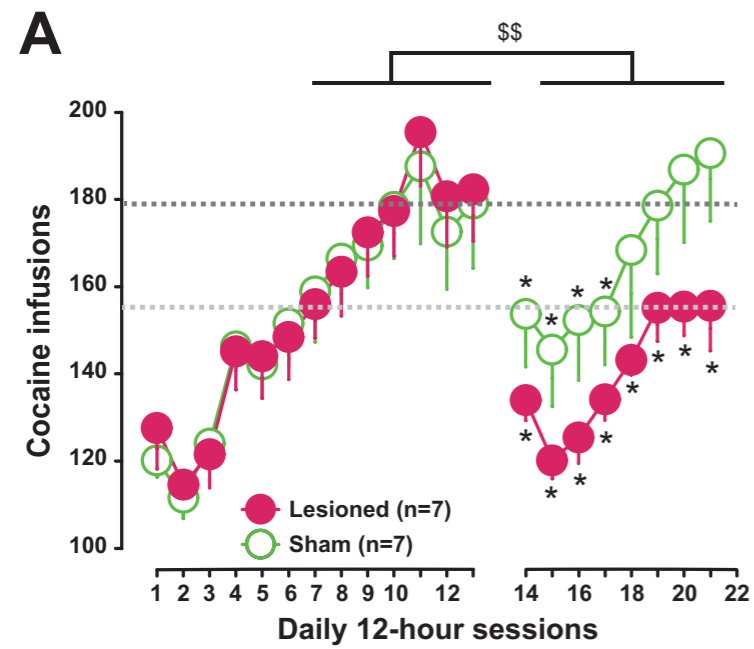
A



B



Towards an evidence? AI and escalation of cocaine intake

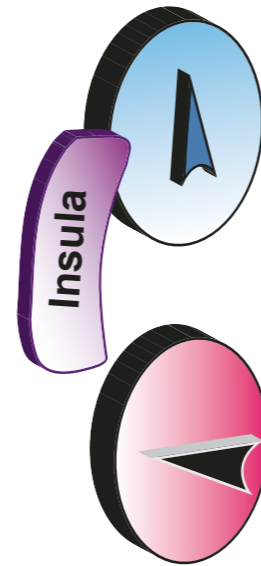
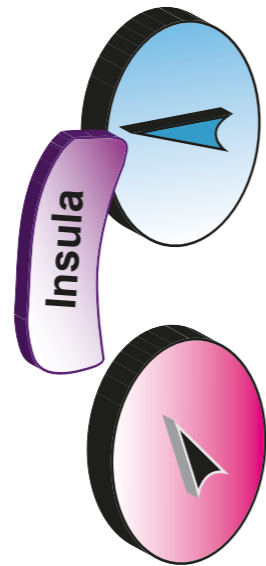


Baseline

Chronic aversiveness

Reward
system

Reward
system



Aversive
system

Aversive
system



Impulsivity

Compulsivity

Acknowledgements

Aude Belin-Rauscent
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Ruth Dilleen
Jenn Murray

Jeff Dalley
Trevor Robbins

Barry Everitt



AXA
Research Fund
Through Research, Protection



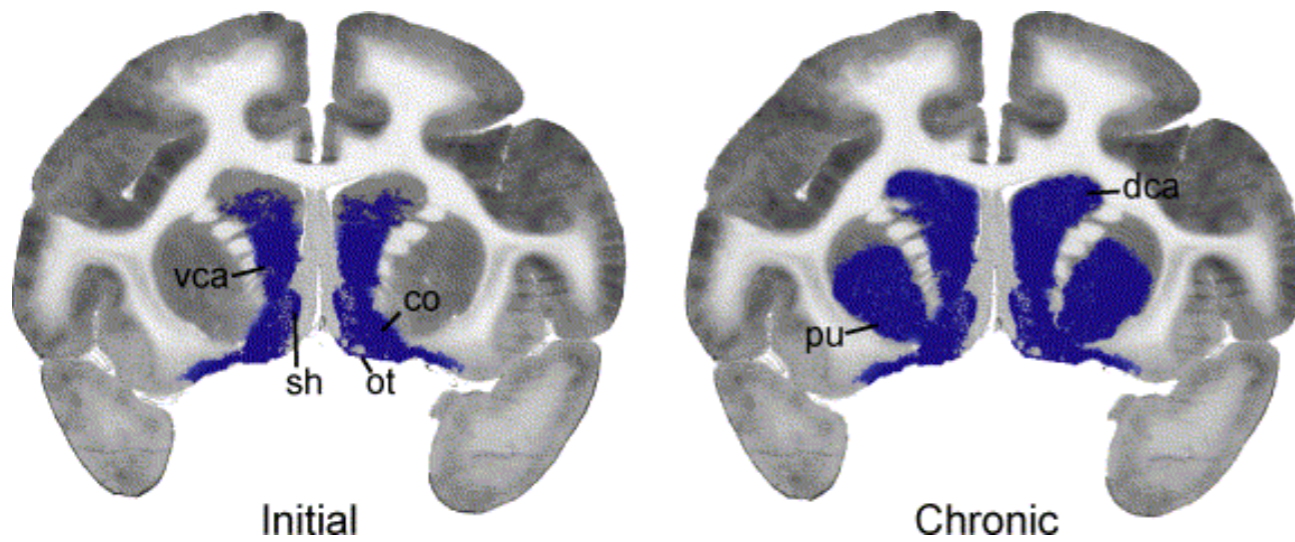
FONDATION
RECHERCHE
MÉDICALE



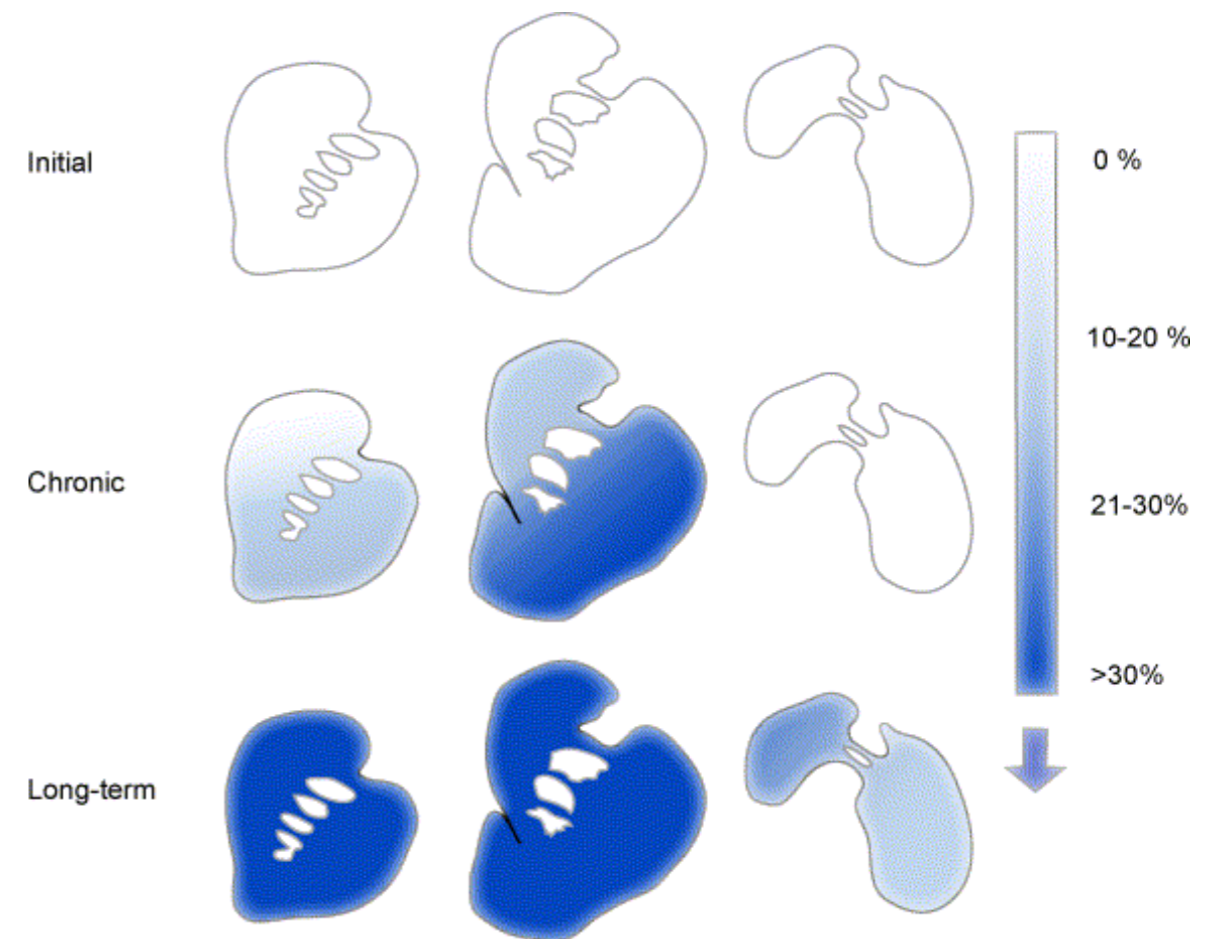
Fondation Fyssen



Intrastriatal shifts in the course of drug exposure

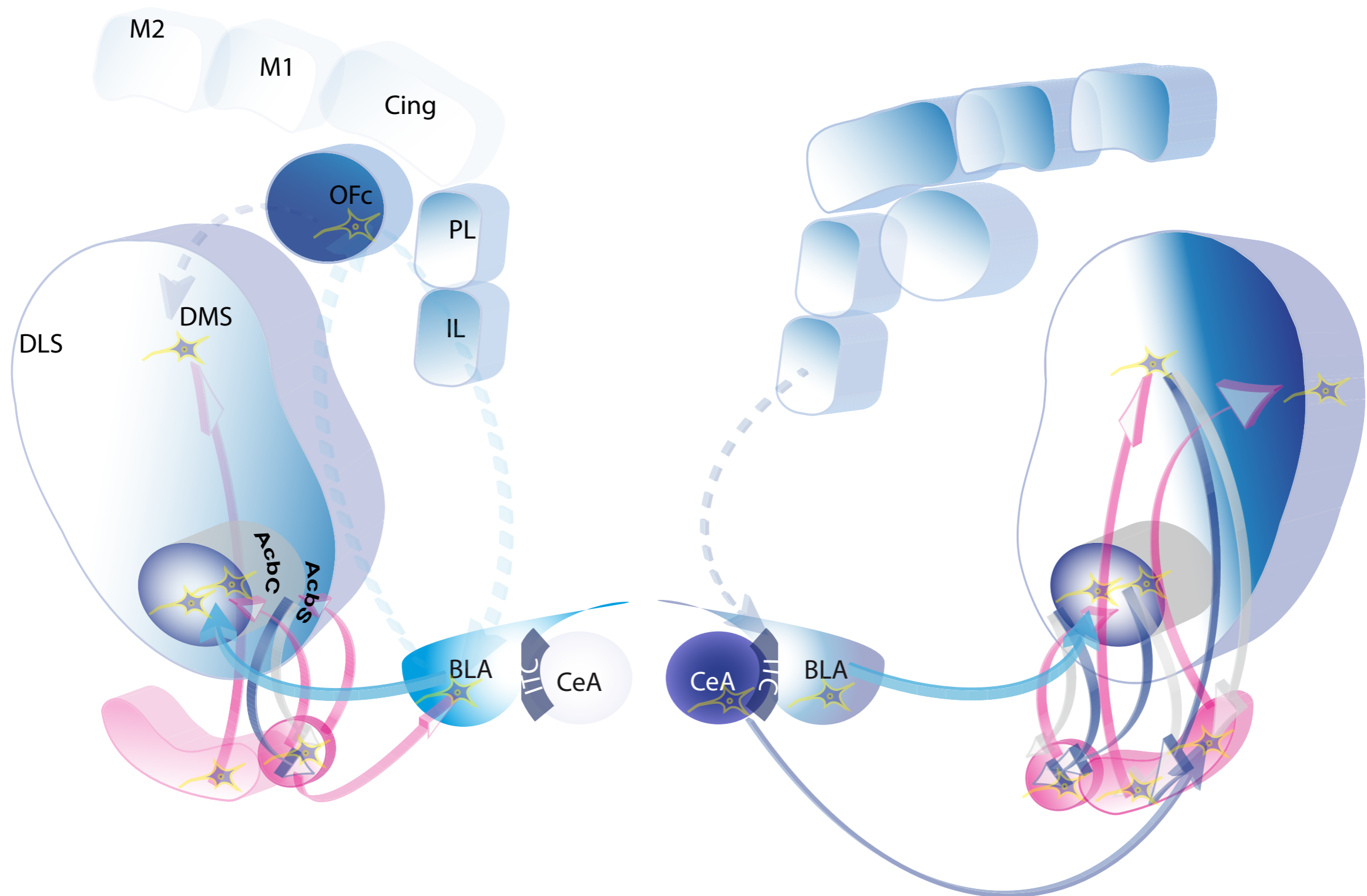


2DG metabolic activity decreases

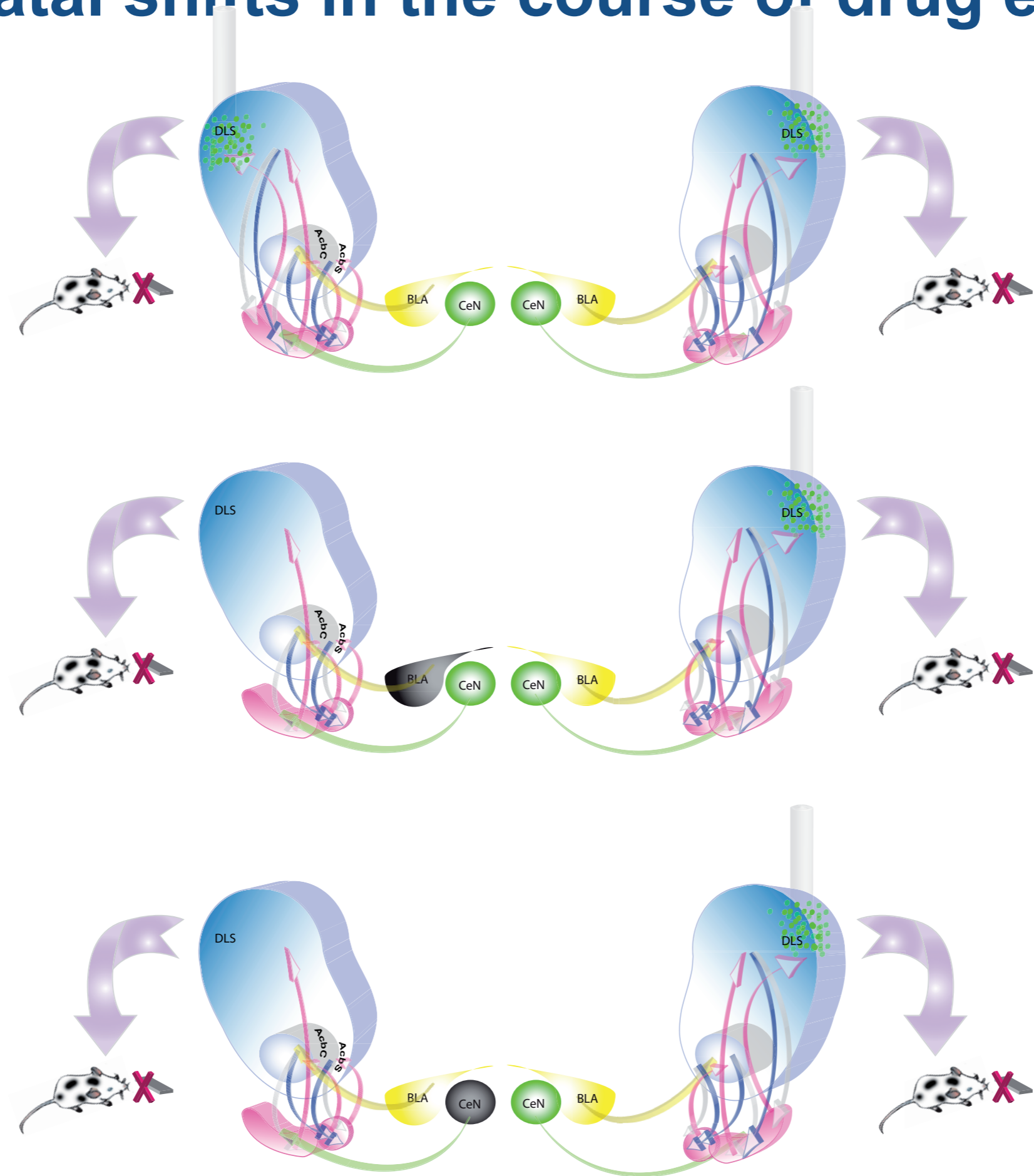


D2 binding site decreases

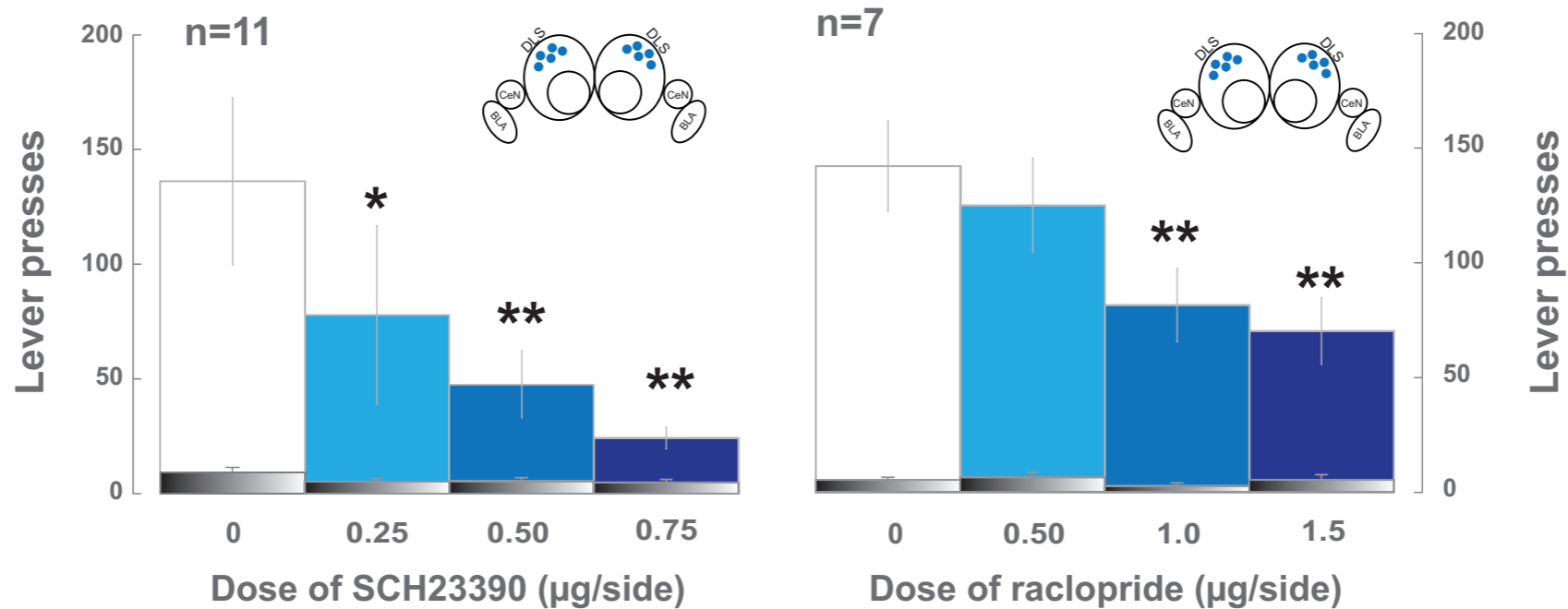
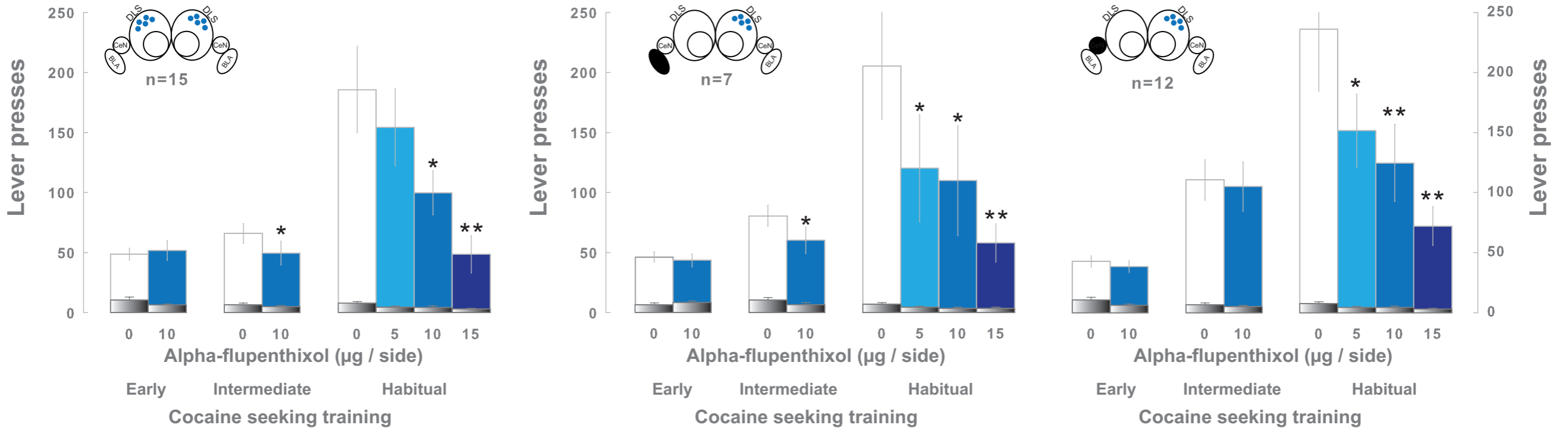
Intrastriatal shifts in the course of drug exposure



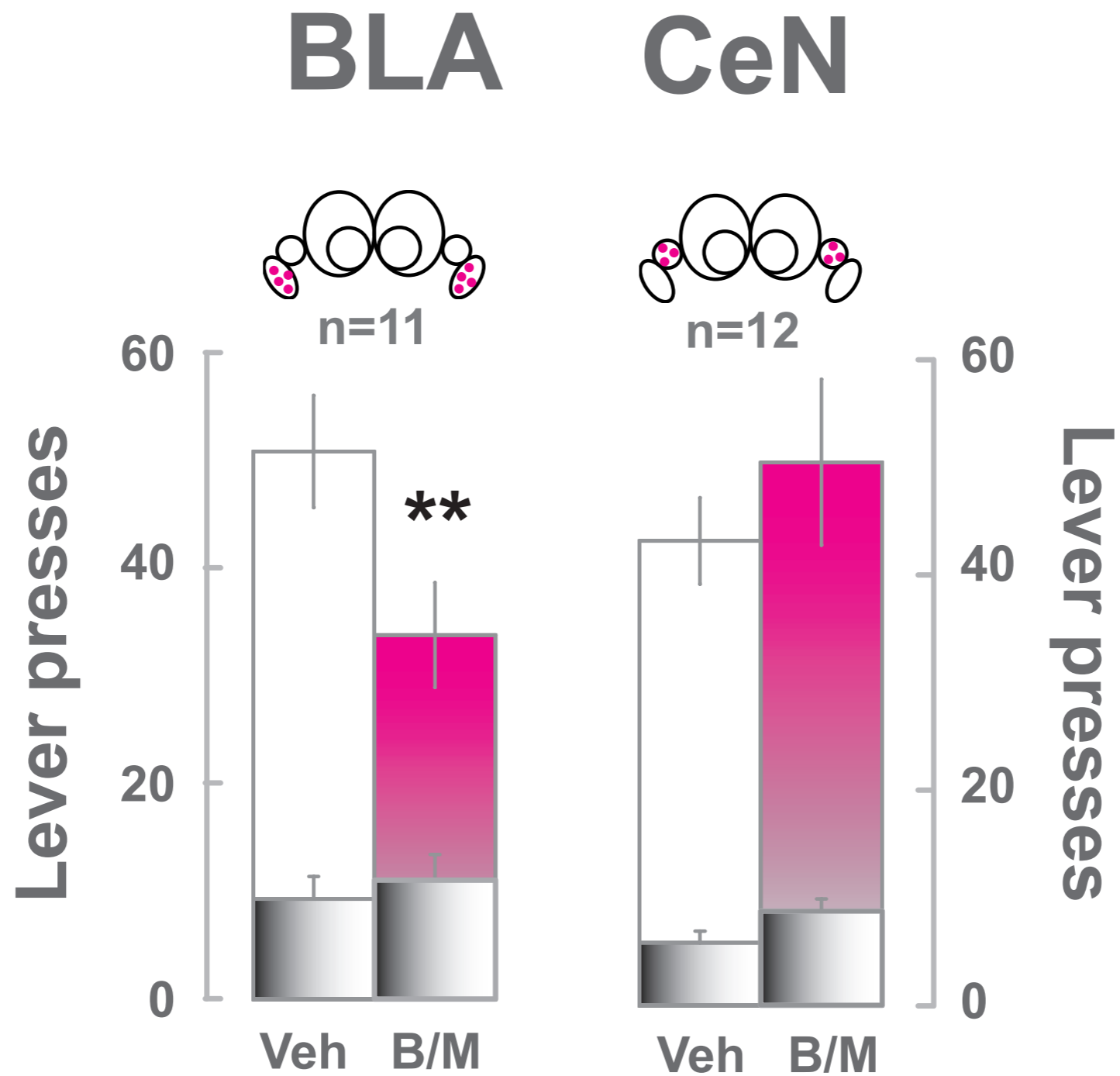
Intrastriatal shifts in the course of drug exposure



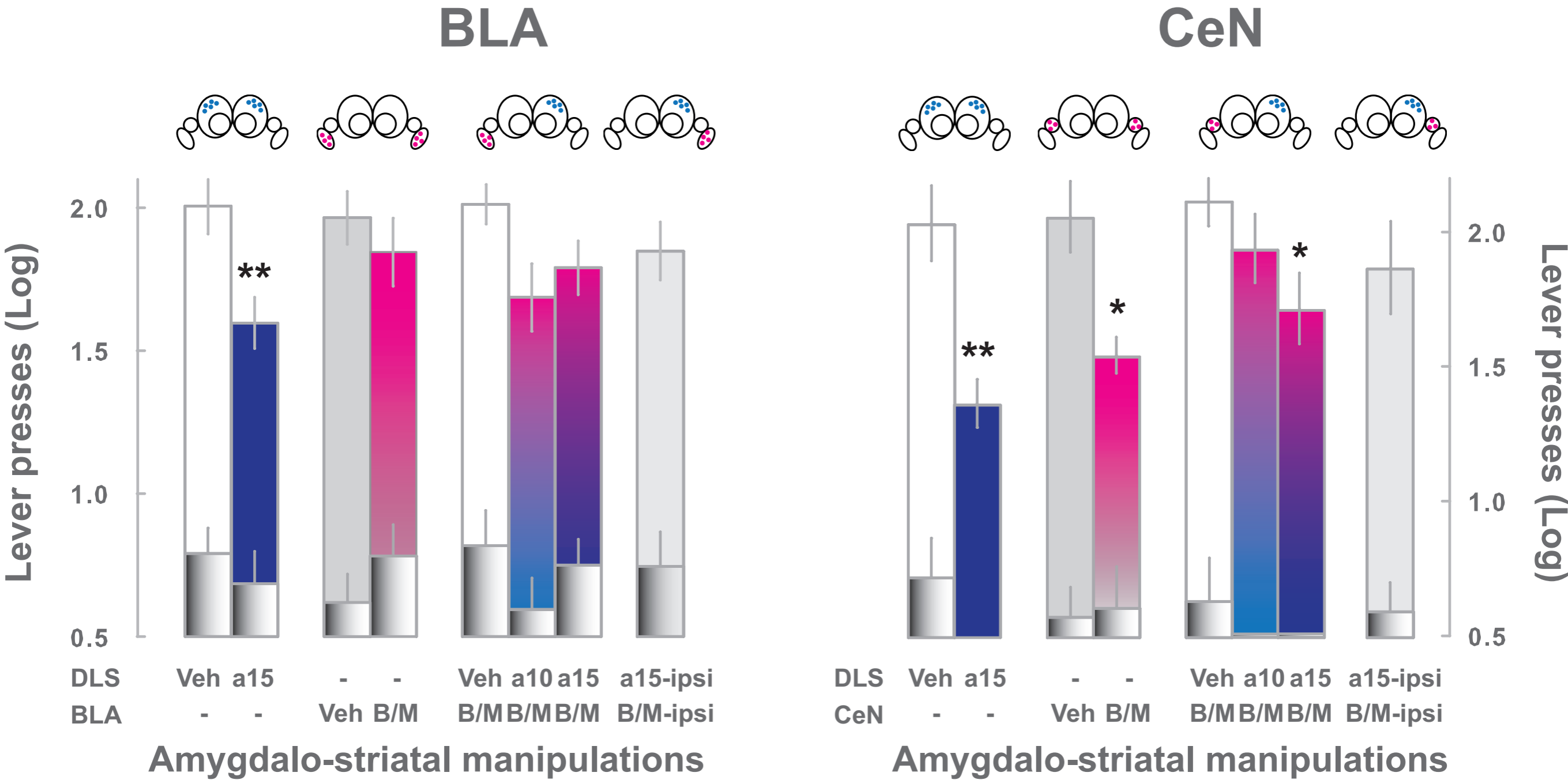
Intrastriatal shifts in the course of drug exposure



Intrastriatal shifts in the course of drug exposure



Intra-striatal shifts in the course of drug exposure



Intrastriatal shifts in the course of drug exposure

