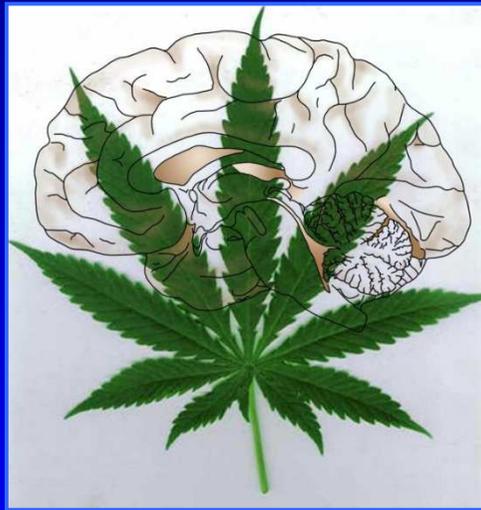


Acute psychotropic effects of Δ^9 -tetrahydrocannabinol (THC) associated with resting state brain function in the human insula: a pharmacological MRI study



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Disclosures

- Nothing to disclose



Outline

- Acute effects of cannabis
- Assessment of:
 - Subjective effects of THC
 - Impact of THC on resting state perfusion
 - Correlations between subjective and perfusion effects
- Summary & conclusions



Acute effects of cannabis

Cannabis produces a broad range of acute psychotropic effects, mainly induced by Δ 9-tetrahydrocannabinol (THC)

Euphoria
Relaxation
Laughter
Increased appetite
Increased creativity
Perceptual changes
(music, time, space)

Increased heart rate
Reddening eyes
Dry mouth

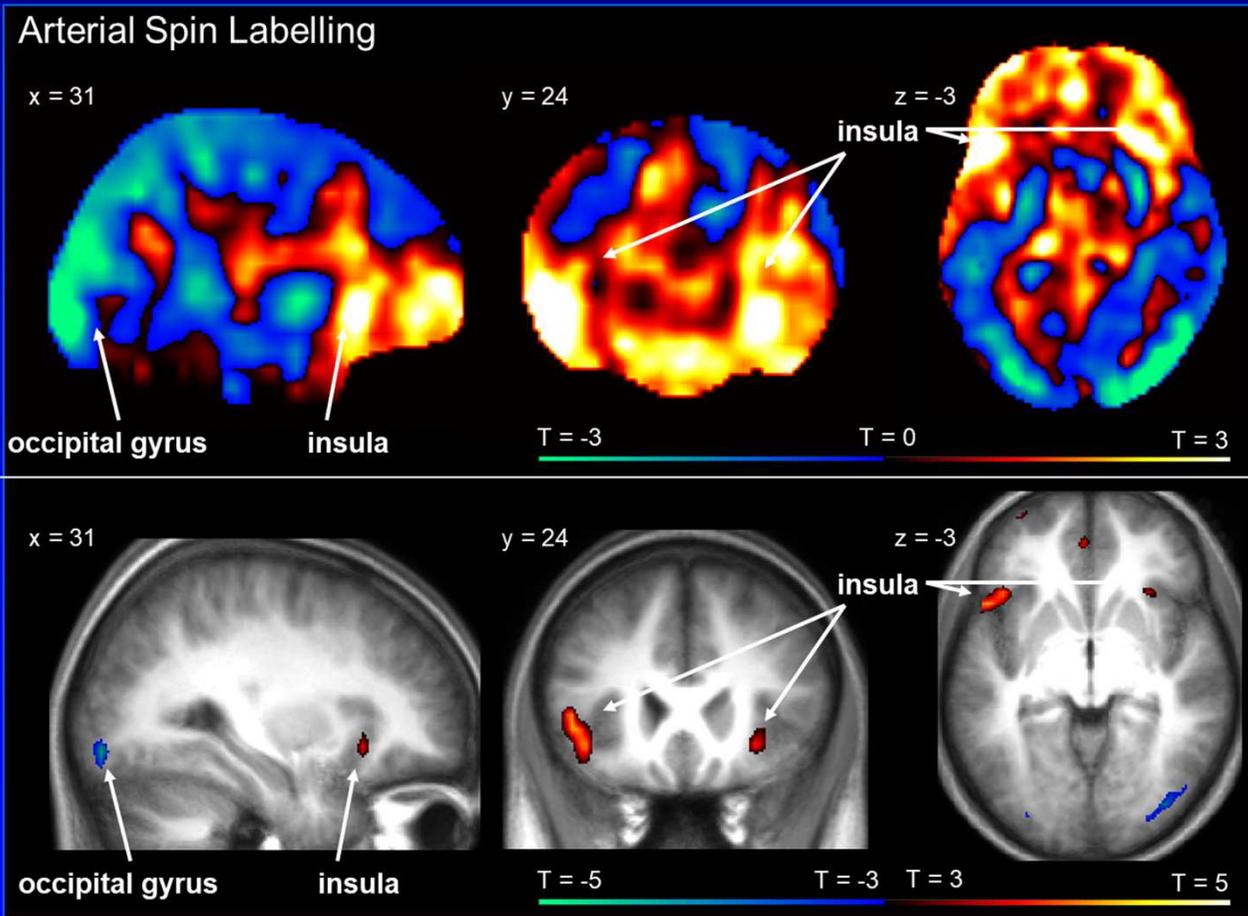
Impaired learning and memory
Acute hallucinations
Anxiety or panic attacks





THC and resting brain function

A limited number of neuroimaging studies examined the acute impact of cannabis on resting state brain function, thereby mapping its effects



N=20, $T > 3.6$, $p < 0.001$ uncorrected

Van Hell et al. (2011) - Int J Neuropsychopharmacology

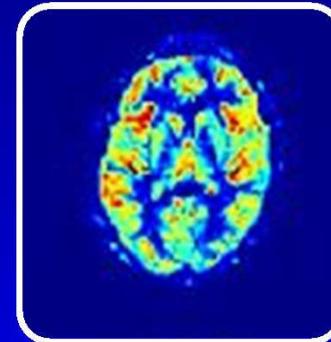


Research question & design

How does cannabis produce its acute psychotropic effects in the human brain?



39 healthy participants



Double-blind, randomised, placebo-controlled cross-over pharmacological MRI study with THC administration

Test day 1

At least two weeks

Test day 2



Administration & subjective effects

THC (6 mg) and placebo were administered with a Volcano vaporizer



Subjective effects were assessed with composite visual analogue scales

Perception

Thoughts

Tranquil

High

Time

Relaxation

Mentally slow

Dreamy

Drowsy

Muzzy

Dysphoria

Suspicious

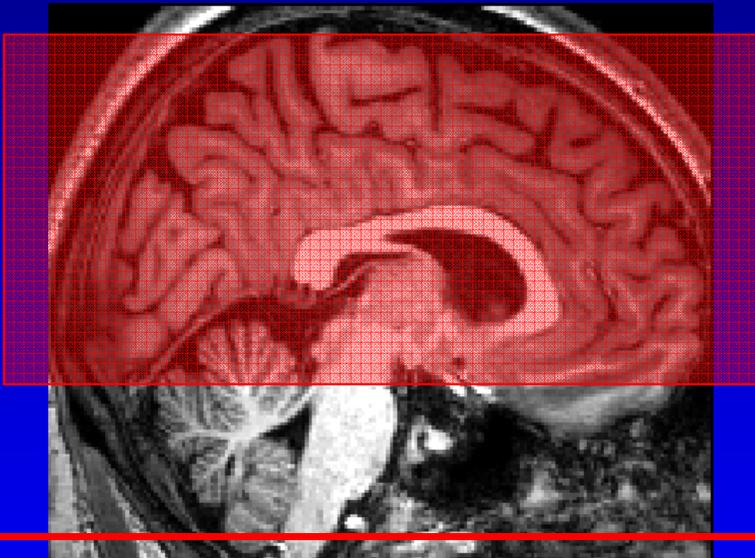
Meaning

Voices



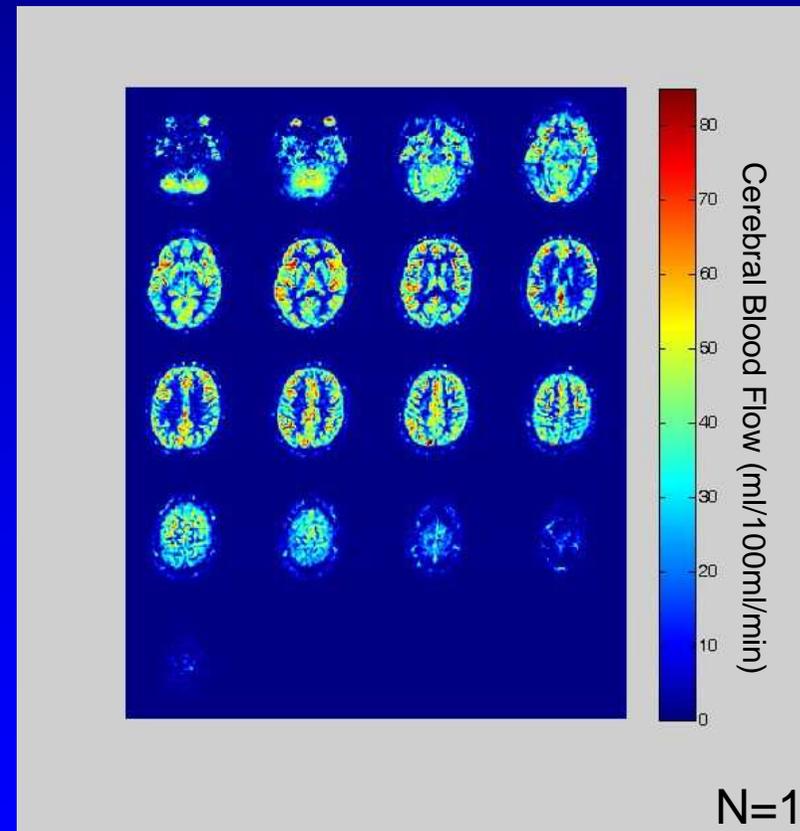
Arterial Spin Labelling

THC effects on resting brain function measured with Arterial Spin Labelling (ASL), which provides a quantitative measure of perfusion



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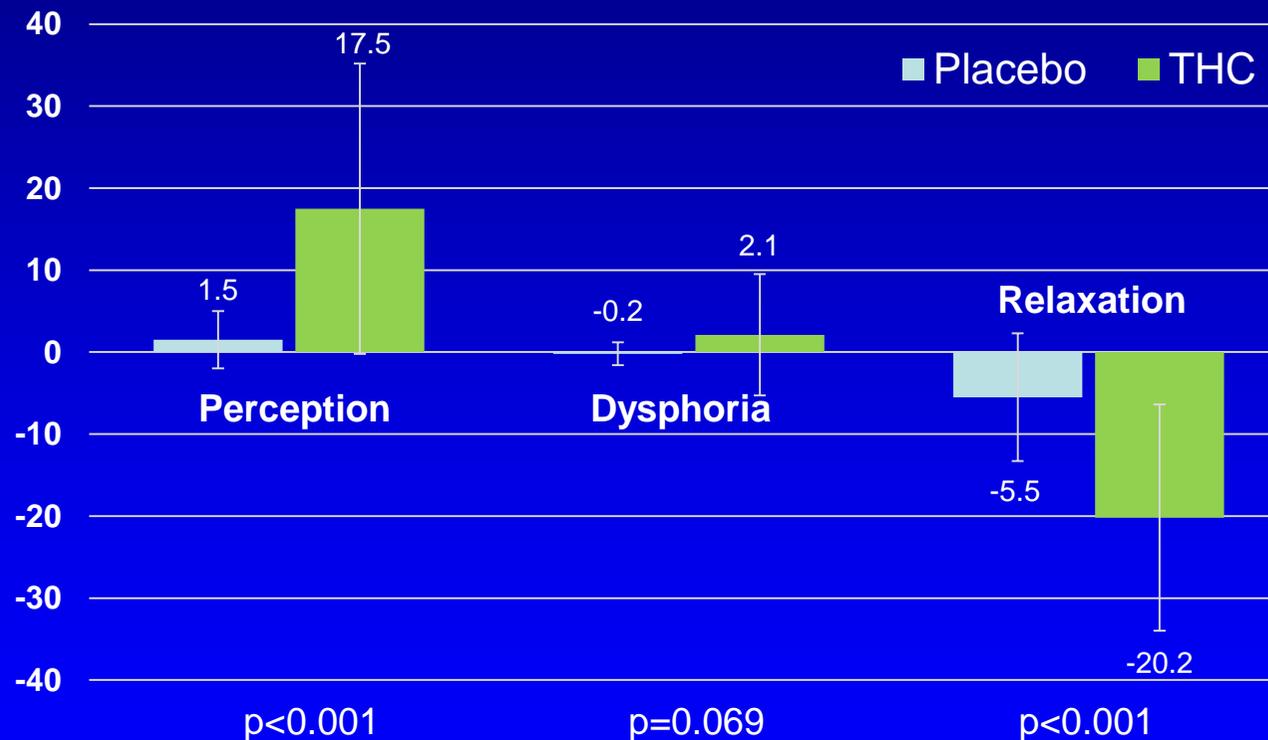
- Scans obtained 1.5 sec after tagging
- Cerebral Blood Flow = tagged – control





Results: subjective THC effects

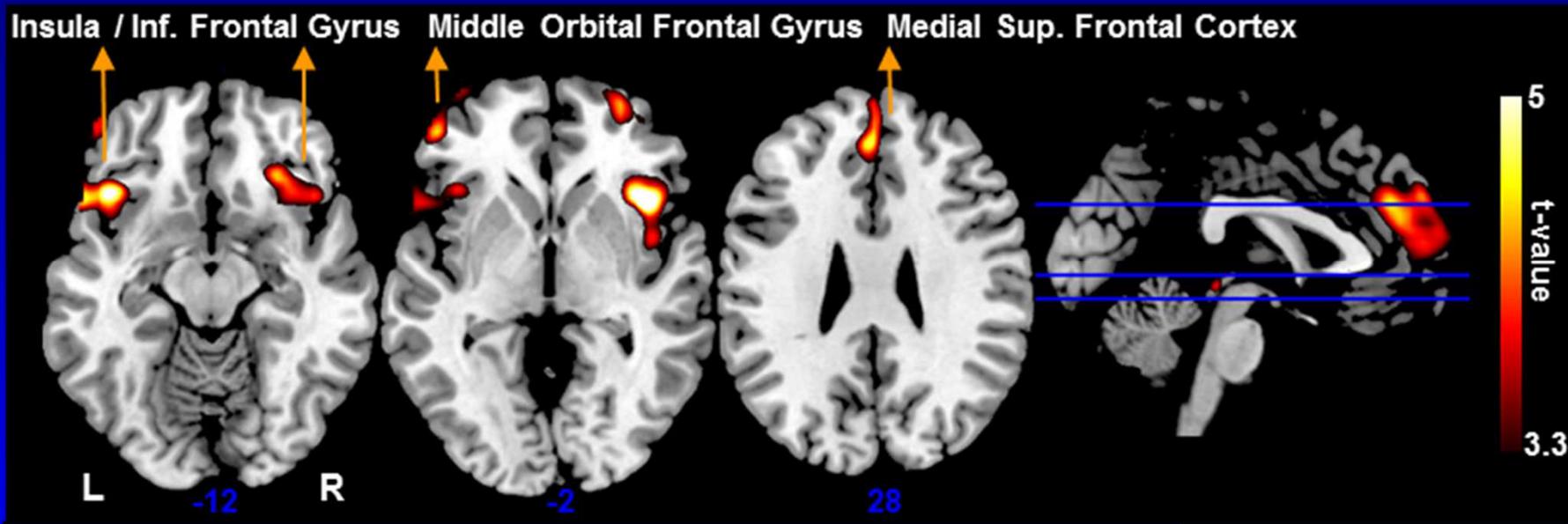
THC induced a significant increase in the subjective rating of 'perception' and a significant reduction in 'relaxation'





Results: effects on perfusion

THC significantly increased perfusion in both left and right insula, medial superior frontal cortex, and left middle orbital frontal gyrus



Brain region	BA	mm ³	p value	x	y	z	Max T
Insula / Inferior Frontal Gyrus R	47	8344	<0.001	40	20	-2	6.06
Insula / Inferior Frontal Gyrus L	38	5224	0.003	-44	22	-12	5.21
Medial Superior Frontal Cortex	32	4440	0.005	-2	44	28	4.77
Middle Orbital Frontal Gyrus L	46	2664	0.026	-48	48	-2	4.56

There were no brain areas showing a significant decrease in perfusion after THC administration

N=33, FDR-corrected at cluster level, p<0.05

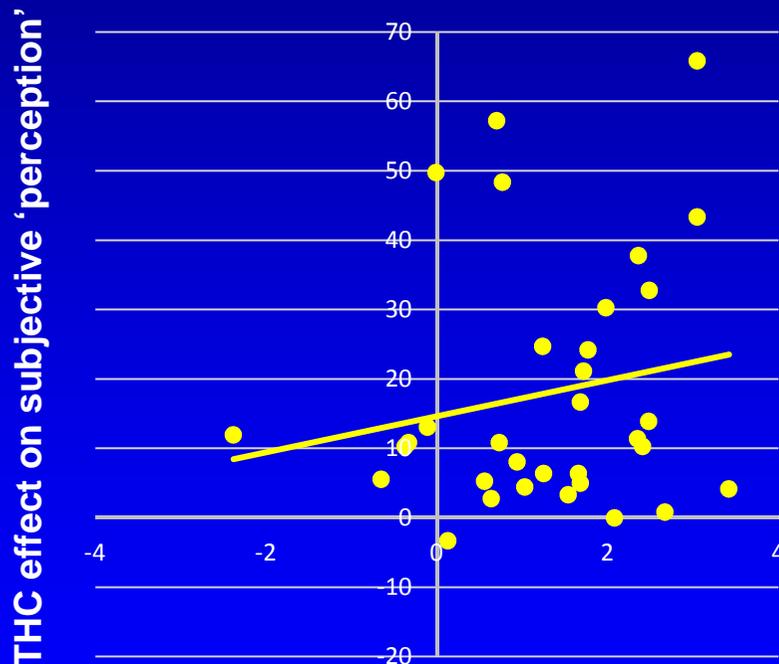
Bossong et al. (2019) - European Neuropsychopharmacology



Results: correlations

Subjective ratings of 'perception' and 'relaxation' were significantly related to THC effects on perfusion in the left insula

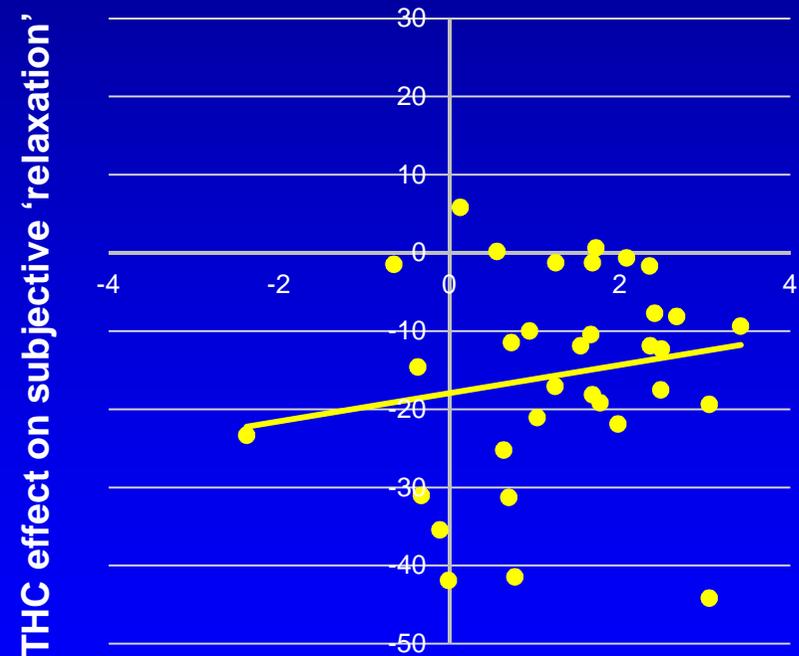
perception



THC effect on perfusion in left insula

$\beta=0.629$, $p=0.014$

relaxation



THC effect on perfusion in left insula

$\beta=0.540$, $p=0.020$



Conclusions

How does cannabis produce its acute psychotropic effects in the human brain?

THC significantly increased perfusion in insula and medial superior frontal cortex, indicating elevated neural activity in salience network

Findings in line with previous resting state studies, suggesting a THC-induced increase in awareness and anticipation of salient information

Consistent with description of typical THC effects, such as perceptual alterations, time distortion and intensification of ordinary experiences

Correlations between THC effects on perfusion and subjective measures further suggest that the main acute psychotropic effects of THC are mediated through recruitment of the salience network



Conclusions

Acute effects of Δ^9 -tetrahydrocannabinol (THC) on resting state brain function and their modulation by COMT genotype

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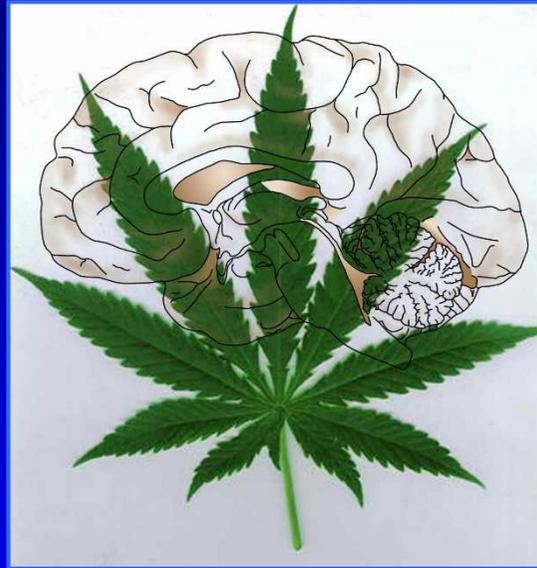
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Questions?



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