

# Sensory Processing SensiTivity AND drug Use recovery Pathways

## STANDUP

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Maria Melchior (FR)

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What do these people have in common?





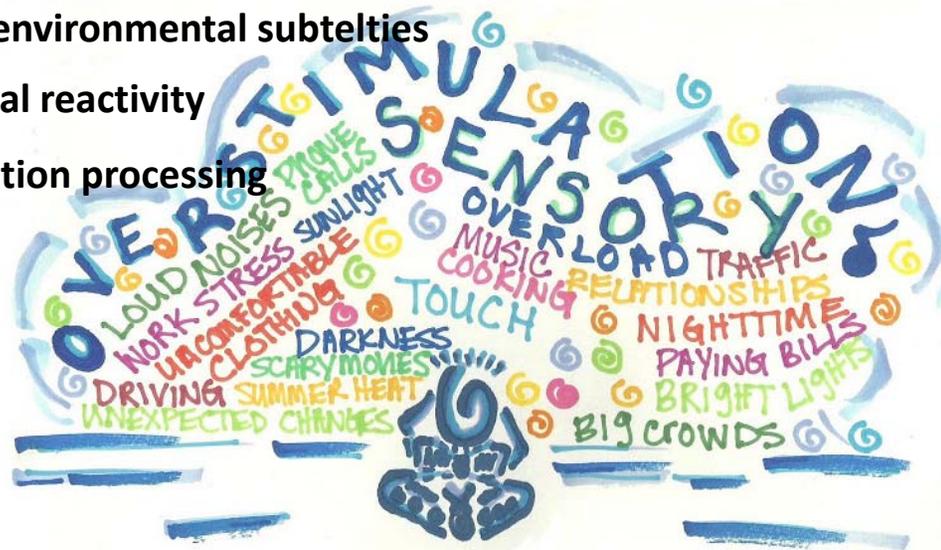
## Sensory Processing Sensitivity: trait predicting drug use pathways?

Based on individual differences in environmental sensitivity found in > 1000 animal species



- Openness to environmental subtleties
- High emotional reactivity
- Deep information processing

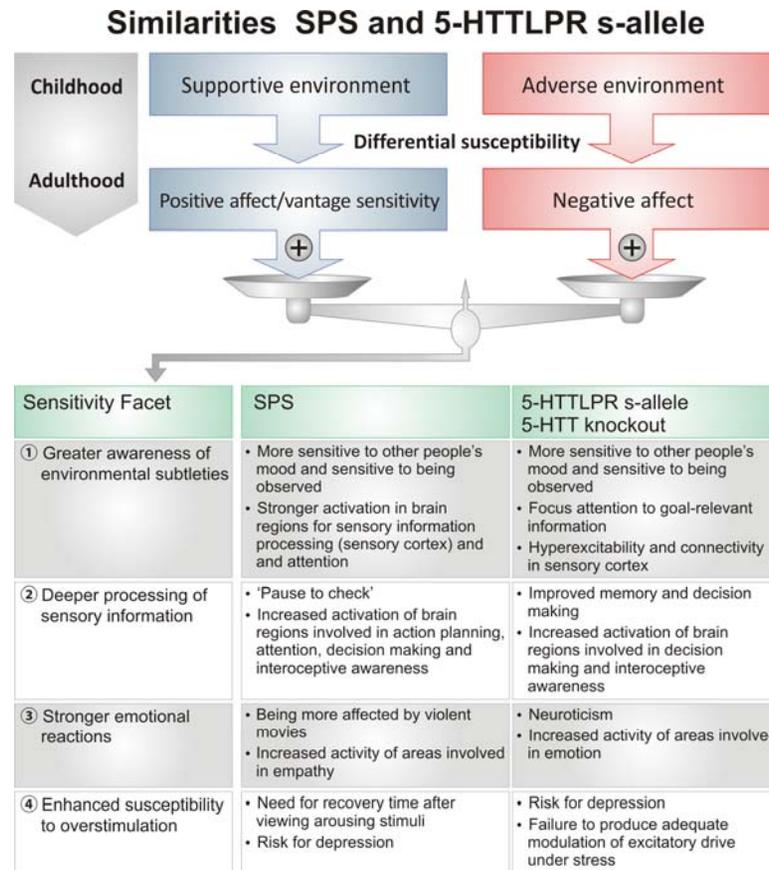
↓  
Creativity



Drug use

Drug use

# Sensory Processing Sensitivity and the serotonin transporter polymorphism



Homberg, [...], Aron et al., 2016; Neurosci Biobeh Rev



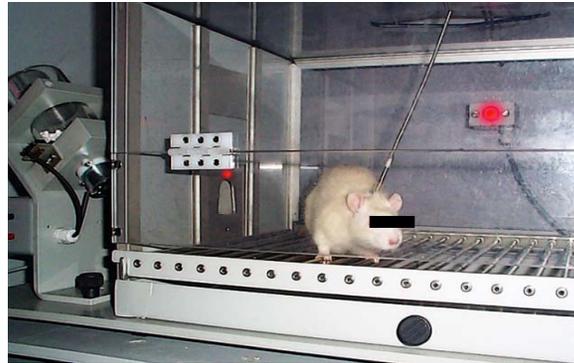
## Animal models

### 1) 5-HTT KO rats

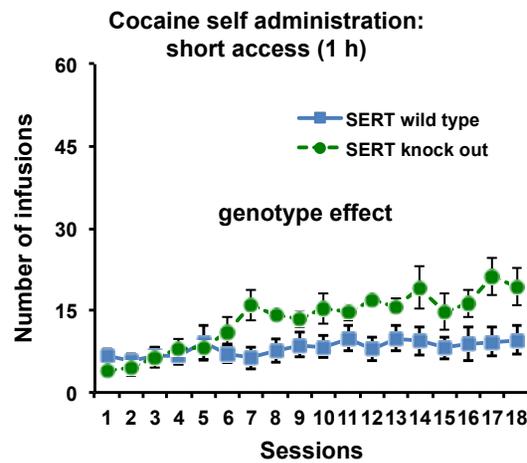
SPS sensitivity facets	
High SPS subjects show:	Resulting phenotypes in 5-HTT knockout rats:
① Increased sensitivity to subtle environmental stimuli	① Reduced latent inhibition, reflecting reduced information filtering.
② Stronger emotional reactivity	② Increased emotional reactivity
③ Deeper (self-referential) information processing, reflected as 'pause to check'	③ Increased freezing in response to a threat predicting cue, reflecting a 'pause to check'

### 2) Extremes in a group of wild-type rats selected based on SPS sensitivity facets

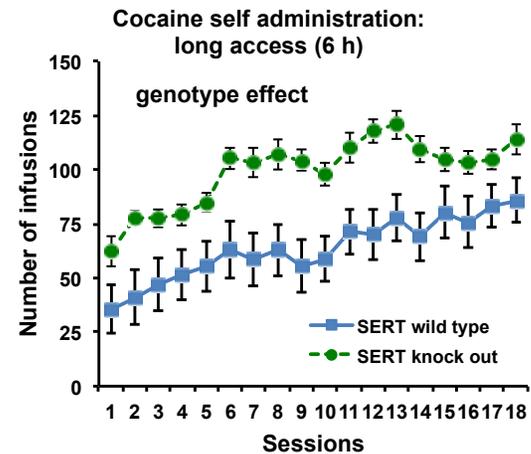
# Cocaine self-administration in serotonin transporter knockout rats



## Regular drug use



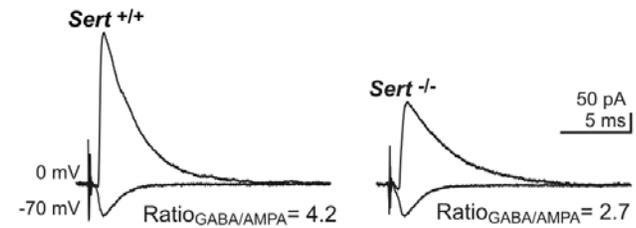
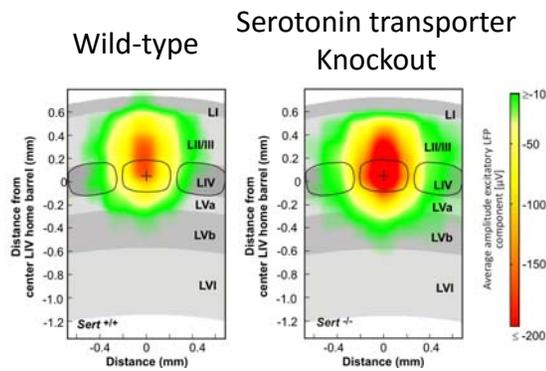
## Compulsive drug use



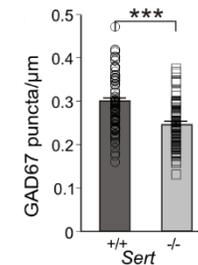
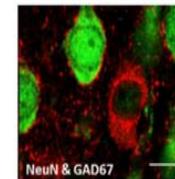


# Cortical hyperexcitability in serotonin transporter knockout rats

Psychologists say: “High SPS persons have a hypersensitive brain”. What does this mean?



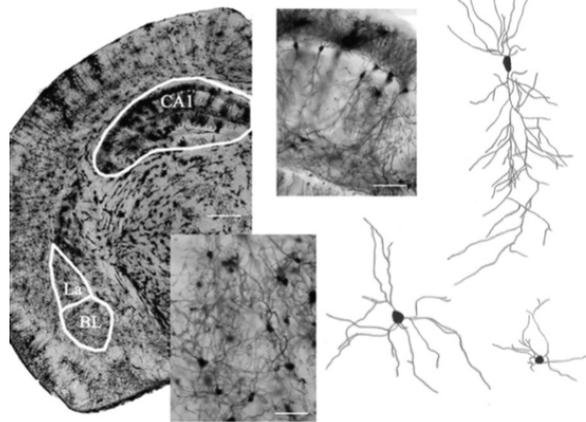
Homberg, [...], Aron et al., 2016; Neurosci Biobeh Rev  
Miceli et al., 2017; Cerebral Cortex



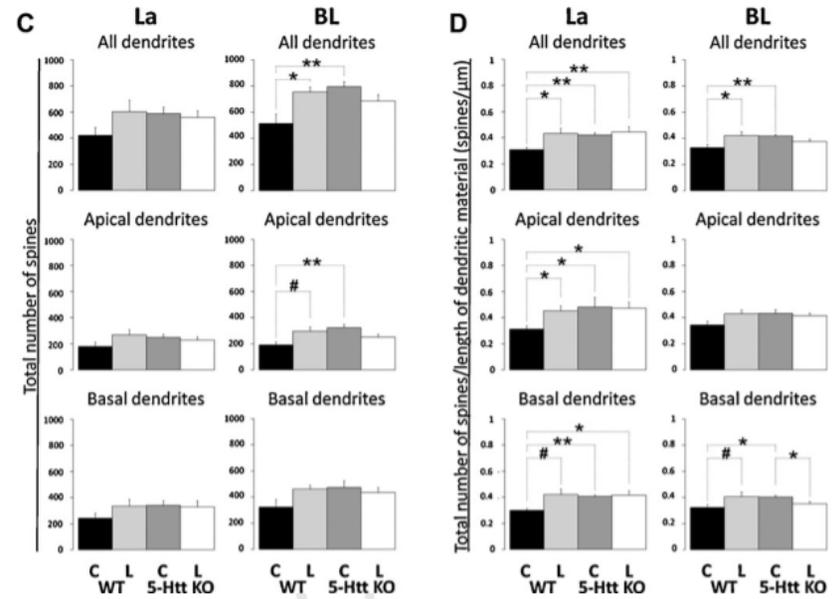
# Effect of social stress on hyperexcitability



Amygdala and Hippocampus



Nietzler et al., 2011





## Hypothesis



Individuals high on SPS have a hypersensitive brain due to reduced cortical inhibitory (GABAergic) control over excitatory (glutamatergic) neurons. High SPS individuals are expected to hit ceiling levels of neur(on)al activity, which shapes environmental sensitivity, flexibility and creativity, but leaves only a small dynamic range of neuroadaptation to deal with overstimulation/stress.



## Aims

We aim to elucidate whether: (1a) overstimulation increases drug use in individuals high on SPS and (1b) supportive social environmental factors can buffer against overstimulation and reduce drug use in individuals high on SPS.

➔ WORK PACKAGE 1

Additionally, we aim to identify (2) biomarkers of SPS-environment-drug use pathway links.

➔ WORK PACKAGE 2

### High SPS

Adverse social environment	Increase in drug use
Supportive social environment	Decrease in drug use

## Relevance

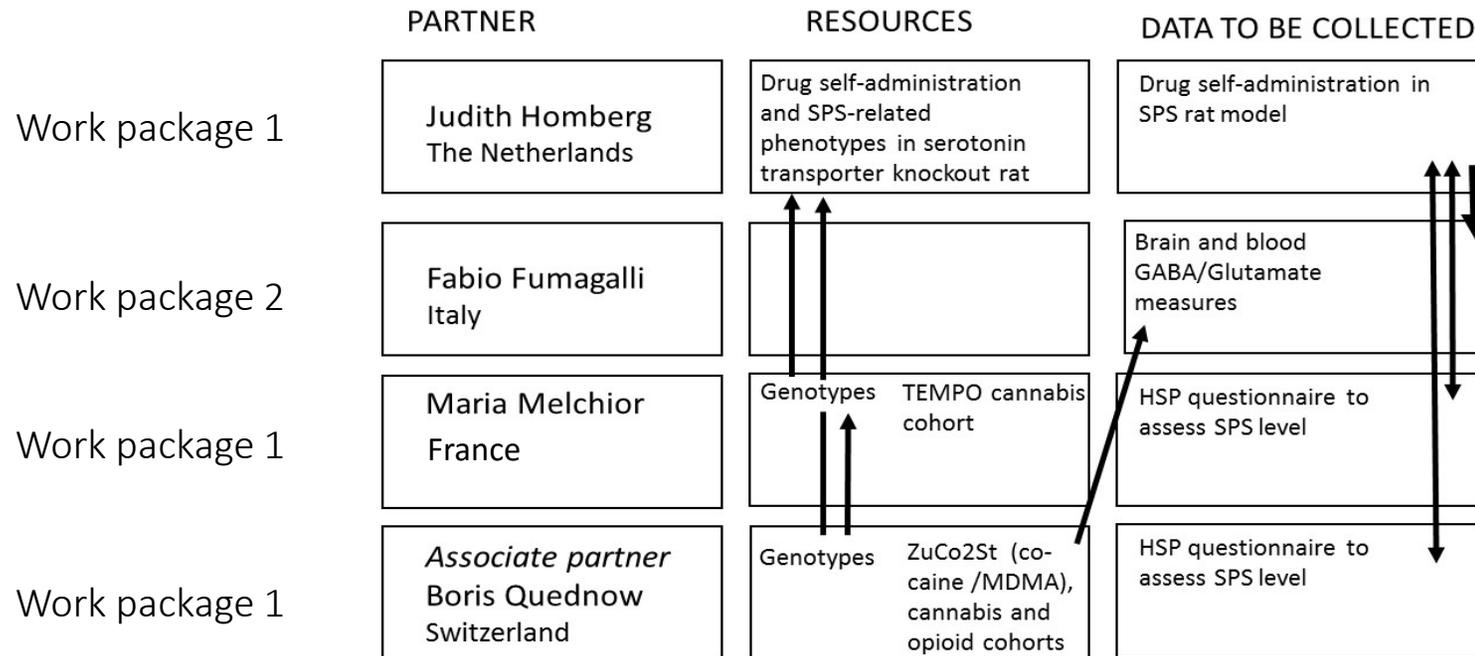


By gaining insight into the social environmental factors that – as a function of SPS level – influence pathways to drug use and recovery, this project brings the opportunity to formulate recommendations for propitious therapeutic interventions relying on supportive social environmental factors.

## Stakeholders

- Dr. Michael Pluess (UK): Psychologist and expert in SPS
- Mrs. Laurène Collard of the French Fédération Addiction (FR): a network supporting addiction health care professionals and the implementation of prevention and treatment regimes
- Mr. Marcello van den Anker (NL): Drug user expert

## Project organization and collaboration between partners





## Task 1.1. Boris Quednow (CH)

Cohort: Zurich Cocaine Cognition Study, ZuCo<sup>2</sup>St

Males (115)/females (75)

Primary cocaine or MDMA, secondary 2C-B, cathinon and ketamine

Questionnaire (incl. life events), PET, and MRS data, blood

Cohort: Opioid

Males (20)/females (20)

Questionnaire (incl. life events) and social cognition data, blood

Cohort: Cannabis

Males (50)/females (50)

Questionnaire (incl. life events) and neuroimaging data

SPS: [http://hsperson.com/pdf/HSPSCALE\\_2007\\_research.pdf](http://hsperson.com/pdf/HSPSCALE_2007_research.pdf)

## Task 1.2. Maria Melchior (FR)



Cohort: TEMPO

1103 subjects

Primary cannabis

Questionnaire data (incl. life events), saliva

Berkman Social Networks and support inventory: unemployment, marital separation, romantic love, labour market entry, etc.

SPS: [http://hsperson.com/pdf/HSPSCALE\\_2007\\_research.pdf](http://hsperson.com/pdf/HSPSCALE_2007_research.pdf)



## Task 1.3. Judith Homberg (NL)

### Selection of high and low SPS rats

Table 1 - Test	Procedure	Outcome
1. Elevated plus maze	Rats explore the elevated plus maze for 5 min	Percentage time open arms
2. Conditioned freezing	Rats are presented 5 tones ending with footshock exposure. 24 hrs later 24 tones are intermittently presented in a novel cage	Percentage of conditioned freezing
3. Prepulse inhibition	Rats are exposed to 120 dB startles, some are preceded by 3, 5 or 10 dB prepulses above background	Average percentage of PPI

- Social enrichment
- Social isolation
- Social isolation followed by social enrichment

– Social behaviour and preference/memory

- Intravenous cocaine/amphetamine/cannabis/heroin self-administration



Brain tissue for Italy

## Task 2.0. Fabio Fumagalli (IT)



### Samples:

Blood from ZuCo2St

Saliva from TEMPO cohort

Brain and blood from rats

### Measures (ELISA, RT-q-PCR, Western blotting):

Blood/saliva: GABA, GLUTAMATE

Brain: GABA and GLUTAMATE signaling components

## Deliverables



Deliverable	Activity	WP	Task	Month
D1	Report on drug use pathways and associated (social) cognitive, genetic and brain GLU/GLN features as function of SPS level and social environmental conditions in humans	1	1.1	18
D2	Report on relationships between SPS and drug use depending on positive and negative characteristics of individuals' social environment as well as gender.	1	1.2	36
D3	Report on the validity and acceptability of the HSP measure in France.	1	1.2	24
D4	Report on the causal relationship between SPS level, social environmental conditions, social behaviour and pathways to drug use and recovery in rats	1	1.3	30
D5	Report of biomarkers of drug use and recovery pathways as function of SPS and environmental conditions	2	2.1	36



## Dissemination activities

Target audience	Key messages/information	Dissemination tools
<b>General public</b>	<ul style="list-style-type: none"><li>Increase public awareness of the relationship between SPS, environment and drug use</li></ul>	Messages on HSP websites, institutional websites, Intervention in mass media (press releases, events), presentations at public meetings
<b>Scientific community</b>	<ul style="list-style-type: none"><li>To inform scientists across disciplines (psychology, neurobiology, clinical medicine, psychiatry)</li></ul>	Open access scientific journals, newsletters, presentations at national and international meetings, organisation of an international conference
<b>Stakeholders</b>	<ul style="list-style-type: none"><li>To coordinate activity, promote collaboration and facilitate interpretation of results</li></ul>	Personal contacts, Scientific journals, newsletters
<b>Physicians</b>	<ul style="list-style-type: none"><li>Recommendations for promoting healthier habits to deal with overstimulation</li></ul>	Personal contacts, teaching, Newsletters, Science Blitz, medical journals, presentations at clinical meetings
<b>Patients</b>	<ul style="list-style-type: none"><li>To create awareness on relationship between SPS and substance related disorders</li><li>Recommendations for promoting healthier to deal with overstimulation</li></ul>	Personal contacts with associations, Patient association newsletters
<b>Policy makers</b>	<ul style="list-style-type: none"><li>To create awareness on relationship between SPS and drug use</li><li>To creative awareness of the impact of environmental factors on mental health</li></ul>	Existing collaborations and membership of boards, Lobbying, science blitz

## Project meetings



Kick off meeting (Nijmegen)

Midterm meeting (Paris)

Final meeting (Milan)





Thank you for your attention!