The Mind Expanded
Psychedelics and the Brain: Insights from Neurobiology

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Dr. Brewer owns stock in, and serves as a paid consultant for Sharecare Inc., the company that owns the mindfulness apps described in this talk. The financial interest has been disclosed to and is being managed by my institution, Brown University, in accordance with its Conflict of Interest and Conflict of Commitment policies.
Podcast series: “Seeing White” (E.g. Hoffman PNAS 2016)
Cue/Trigger
(sight, smell, thought, emotion, body sensation)

MIND
(evaluation, interpretation)

Pleasant
Unpleasant

CRAVING

Behavior

Birth (of self-identity)

Memory (“me”)

Habit formation and reinforcement

“Whatever a [person] frequently thinks and ponders upon, that will become the inclination of his mind.”

MN 19 “Two kinds of Thought”
(Bodhi trans)
“Ego, the self which he has believed himself to be, is nothing but a pattern of habits”

Alan Watts
Self-centered psychological functioning includes characteristics such as biased self-interest, egoism, egocentrism, and egotism.

Dambrun & Richard 2011
“Your me is in the way”

- Hui Hai
Default Mode Network (DMN)

Adolescents’ Own Images Many Likes > Few Likes

- Viewed simulated “Instagram” feed
- Brain activation was compared during viewing own images with many > few likes:
  - NAcc
  - PCC/precuneus

Sherman et al (2016)
Cocaine cue-induced craving

Garavan et al Arch Gen Psych (2000)
Viewing smoking pictures activates the DMN

Viewing gambling pictures activates the PCC

Eating chocolate activates the PCC no matter how pleasant

Small et al *Brain* (2001)
Worry activates the DMN

Servaas et al *HBM* (2014)
The curious case of the PCC

– “Resting state” (Raichle 2001)
– Autobiographical memory, Past and future “self” (Schacter 2007, Andrews-Hanna 2010, others)
– Judgment about trait adjectives (Kelley 2002, Whitfield-Gabrieli 2011, others)
– Self-attribution in social situations (Cabanis 2013)
– Liking a choice you made (Jarcho 2011, Kitayama 2012)
– Prevention goals (Strauman 2013)
– Induced immoral behavior (van Veen 2009)
– Care and justice issues (Caceda 2011)
– Guilt (Morey 2012)
– Craving (Garavan 2007, Brody 2007, Jarraya 2010)
How do studies of the PCC converge?

• What about the self is processed in the PCC? (Brewer, Garrison and Whitfield-Gabrieli, 2013)
  – “getting caught up” in experience? (Garrison et al 2013)
  • Experiential self?
• mPFC – conceptual self? (Qin 2011)
Nummenmaa et al (2014)
Self-centered psychological functioning includes characteristics such as biased self-interest, egoism, egocentrism, and egotism.

In contrast, we use the term “selflessness” to qualify the self’s alternative psychological functioning. It is characterized by low levels of self-centeredness and a low degree of importance given to the self (i.e., not exaggerated). This style of psychological functioning is closely related to characteristics such as altruism, kindness, respect, empathy, compassion.

Dambrun & Richard 2011
Task of mindfulness training?

Get out of your own way

(Don’t get caught up in yourself!)
Consistent deactivations after psilocybin

Carhart-Harris 2012
Psilocybin promotes an unconstrained style of cognition

"My thoughts wandered freely"

- ASL study
- BOLD study
- MEG study

Mean values +SE

Placebo
Psilocybin

p = .00003
p = .00006
p = .00005
Changes in functional connectivity of the default mode network during open awareness meditation

B
mPFC

$\beta = -0.17$

$\beta = -0.11$

AG I

AG r

PCC

$\beta = -0.18$

$\beta = -0.16$

$r = -0.595$

$p = 0.006$

$\Delta FC$ mPFC – PCC (Open Awareness)
Decreased DMN activity during meditation in experienced meditators

(all meditations, Experienced > Novice)

Brewer et al. PNAS (2011)
Neural substrate of loving kindness meditation

Reduced BOLD signal in meditators (n=20) v. novices (n=26)

Garrison et al (2014) Brain and Behavior
CAN APP-BASED MINDFULNESS TRAINING CHANGE BRAIN ACTIVITY?

Smoking Stimulus vs. Neutral Stimulus Brain activity measured using fMRI

Baseline PCC reactivity

Randomized vs.

Using

Smoking Stimulus vs. Neutral Stimulus Brain activity measured using fMRI

Change in PCC reactivity

One month later rescan their brains with the same paradigm

Gives us

Craving to Quit NCI QuitGuide

Gives us
DECREASED PCC ACTIVITY CORRELATES WITH DECREASED IN CIGARETTE SMOKING ONLY WITH MINDFULNESS TRAINING

<table>
<thead>
<tr>
<th></th>
<th>C2Q (n = 33)</th>
<th>NCI (n = 34)</th>
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<tbody>
<tr>
<td>PCC activity</td>
<td>r = .39 p = .02</td>
<td>r = .08 p = .65</td>
</tr>
<tr>
<td>Number of modules</td>
<td>r = .49 p = .004</td>
<td>r = .20 p = .24</td>
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Janes et al (2019)
Science is a way of trying not to fool yourself. The first principle is that you must not fool yourself, and you are the easiest person to fool.

-Richard Feynman
Real-time meditation feedback

1 min
baseline

3 min
“active” meditation feedback

So at the beginning, I caught myself, that I was sort of trying to guess when the words were going to end and when the meditation was going to begin. So I was kind of trying to be like “okay ready, set, go!” and then there was an additional word that popped up and I was like “oh shit” and so that’s the red spike you see there...
...and then I sort of immediately settled in and I was really getting into it...
...and then I thought “oh my gosh this is amazing it’s describing exactly what I am saying” and then you see that red spike...
... and I was like “okay, wait don’t get distracted” and then I got back into it and then it got blue again...
…and I was like “oh my gosh this is unbelievable, it’s doing exactly what my mind is doing” and so [chuckles] then it got red again…
...So I just find it really funny because it’s...that’s...to the next question, that’s a perfect map of what my mind was going through.
Neurophenomenology
(Lutz and Thompson 2003)

• Use first-person self-report to better understand cognitive processes related to third-person physiological (e.g., brain imaging) data

• Grounded Theory Method (GTM)
  – Qualitative analysis of self-report data
  – Derive theory from empirical data
Open Code

- Open awareness
- Not "efforting"
- Acceptance
- Calm
- Tranquility
- Relaxation
- Focus on the body
- Focus on the nostrils
- Focus on the graph
- Focus on sensations
- Focus on visual input
- Thinking about work
- Remembering
- Thinking about a place
- Thinking about an object
- Interpreting the task
- Interpreting the graph
- Interpreting experience
- Discomfort
- Emotion
- Surprise
- Restlessness
- Confusion
- Searching

Muddled    Self-related thinking    Deliberating    Memories    Physical sensations    Visual objects    Auditory objects    Mental objects    Displeasure

Distraction  n = 64

Interpreting  n = 56

“Efforting”  n = 19

Discontentment  n = 14

Activation

Distracted Awareness

Controlling

“I worried that I wasn’t using the graph as an object of meditation, so I tried, like, to look at it harder or somehow pay attention more to it”
“Toward the middle I had some thoughts which I don’t see on the graph maybe because I let them kind of flow by”

“I noticed …that the more I relaxed and stopped trying to do anything, the bluer it went”
"NO!
Try not!
DO or DO NOT,
There is no try."
Flow

a mental state when a person is fully immersed in the present in a feeling of energized focus.
There was a sense of flow, being with the breath...flow deepened in the middle.
“The ego is a bottomless pit of suckiness. And so you finally let go of the self that clings to itself (one definition of ego). True freedom comes when ego goes.”

- Shozan Jack Haubner
Be empty of worrying. Think of who created thought. Why do you stay in prison when the door is so wide open? Move outside the tangle of fear-thinking. Live in silence. Flow down and down in always widening rings of being.

- Rumi, “A community of spirit”
Gratitude!
Subjects

Pablo Abrante
Bruce Barton (UMass)
Sarah Bowen (UW)
Willoughby Britton (Brown)
Kathy Carroll (Yale)
Neha Chawla (UW)
Todd Constable (Yale)
Jake Davis (CUNY)
Gaëlle Desbordes (MGH)
Susan Druker (UMass)
Hani Elwafi
Kathleen Garrison (Yale)
Jeremy Gray (Yale)
Elizabeth Hoge (Georgetown)
Sean (Dae) Houlihan
Catherine Kerr (Brown)

Hedy Kober (Yale)
Vera Ludwig
Sarah Mallik
G. Alan Marlatt (UW)
Ashley Mason (UCSF)
Linda Mayes (Yale)
Bill Nardi
Alex Ossadtchi (SSI)
Prasanta Pal
Xenios Papademetris (Yale)
Lori Pbert (UMass)
Mark Pflieger (SSI)
Marc Potenza (Yale)
Maolin Qiu (Yale)
Rahil Rojiani
Alex Roy

Bruce Rounsaville (Yale)
Juan Santoyo (Brown)
Cliff Saron (UC Davis)
Dustin Scheinost (Yale)
Ryan Smith (Laureate Inst.)
Veronique Taylor
Danny Theisen
Evan Thompson (Toronto)
Tommy Thornhill
Nicholas Van Dam (NYU)
Remko van Lutterveld
Andrea Ruf
Katie Witkiewitz (UNM)
Jochen Weber (Columbia)
Sue Whitfield-Gabrieli (MIT)
Patrick Worhunsky (Yale)

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MORE INFORMATION:

- www.drjjud.com
- Free CME courses
- @judbrewer
- Mindfulness Center @Brown
  - www.brown.edu/mindfulnesscenter

INSTRUCTIONS FOR LIVING:

1. PAY ATTENTION
2. BE ASTONISHED
3. TELL ABOUT IT

• Mary Oliver