



# Neurobiology of Spirituality

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## Disclosure

- I have no financial disclosures
- I will briefly discuss the experimental use of non-approved drugs



## Quotations

- Science is not only compatible with spirituality; it is a profound source of spirituality.
  - **Carl Sagan – Astronomer**
- If the brain were so simple we could understand it, we would be so simple we couldn't.
  - **Lyall Watson - Author, Biologist**
- The religion of the future will be a cosmic religion. It will transcend a personal God and avoid dogma and theology.
  - **Albert Einstein**



## Research Definition of Recovery

- Lee Ann Kaskutas, DrPH, et. Al
  - “Elements That Define Recovery: The Experiential Perspective”
- **Conclusions:** Our empirical findings offer specific items that can be used in evaluating recovery-oriented systems of care. Researchers studying recovery should include measures that extend beyond substance use and encompass elements such as those examined here—e.g., self-care, concern for others, personal growth, and developing ways of being that sustain change in substance use.
  - (*J. Stud. Alcohol Drugs*, 75, 999–1010, 2014)



## The Kaskutas Study

- The survey included 47 recovery elements developed through qualitative work followed by an iterative reduction process.
- A list of 35 such characteristics (Elements) were endorsed by >90% of a group of 9,341 responders in long term recovery who said that these “Elements” belonged in a definition of recovery
  - These Elements can be categorized into five groups(Roy categorization)
    - Authenticity
    - Emotional competence
    - Healthy Relationships
    - Right sizing of ego and spirituality
    - Abstinence



## Right Sizing of Ego and Spirituality

- A process of growth & development
- Living a life that contributes to society, to your family, or to your betterment
- Being the kind of person that people can count on
- Being grateful
- About giving back
- Appreciating that I am part of the universe, something bigger than myself
- Becoming more open-minded about spirituality than before
- Feeling connected to a spiritual being or force that helps me deal with the difficulties of life
- Spiritual in nature and has nothing to do with religion



## Systemic Racism

Racial Breakdown	Percent of U. S. Population	Percent of AA Membership
White	60	89
African American	13	5
Latino	19	4
Asian	6	1
Source 2014 AA membership Survey		



## Affiliation with a Religion

75% of young people are not affiliated with an organized religion

Group	Millennials	Gen X	Boomers	Silent
Unaffiliated	29	21	16	9
Source – Pew Research Center 2014				



## Equity Diversity and Inclusion

- A frequent driver of conflict is difference in religious belief
  - Wars have been fought and peoples subjected driven by religious differences
- Recovering people exposed to dogma feel excluded
  - The White Anglo Saxon Protestant origin of AA
  - The language of AA literature
- Proportionately smaller number of non-white AA participants
- But spirituality is universal and does not require a belief system



## Spirituality in Recovery

- Affect
  - A sense of well being
  - Contentment with one's life circumstances
  - Positive affect
  - Feelings of support
- Existential variables
  - Meaningfulness in one's life
- Flow
  - Ability to use highest strengths and abilities
- Spirituality
  - Non-material issues that give a person meaning and purpose in life
- Personality
  - Classification of Strengths
- Mutual help participation
  - AA or other affiliation

• Galanter M 2019



## Daily Reflections – March 13

- The word “entered” . . . and the phrase “entered into the world of the Spirit” are very significant. They imply action, a beginning, getting into, a prerequisite to maintaining my spiritual growth, the “Spirit” being the immaterial part of me. **Barriers to my spiritual growth are self-centeredness and a materialistic focus on worldly things.** Spirituality means devotion to spiritual instead of worldly things, it means obedience to God’s will for me. I understand spiritual things to be: unconditional love, joy, patience, kindness, goodness, faithfulness, self-control and humility. **Any time I allow selfishness, dishonesty, resentment and fear to be a part of me, I block out spiritual things.** As I maintain my sobriety, growing spiritually becomes a lifelong process. My goal is spiritual growth, accepting that I’ll never have spiritual perfection.



## Definition of Spirituality

- There are many, but there are some common components:
  - Acceptance of self
  - Love for others
  - Meaning and purpose in life
  - Connection with the transcendent
    - Oneness with all things
    - Oneness with God
    - Often associated with religion and religious practice
- Every culture and most individuals
  - Hold beliefs
  - Engage in practices

- Koenig HG 2012, 2009, 2008



## The Pursuit of Spirituality

- An effort to explain the unexplainable
- To find wholeness and acceptance
- To transcend everyday existence
  
- All humans
- In all times



## Why Only Humans

- We suppose that only humans seek spirituality
  - Few other animals pass the “Mirror Test” and are self aware
    - Dolphins, orcas, a single elephant – but some lower animals (magpie, wrasse)
- Assuming evolution, humans have:
  - Different brain capacities
    - Significantly the cingulate and frontal cortices
  - Different communication pathways



## How a Brain Thinks

- A thought or memory or projection is like a pattern of cells communicating
- Collections of brain regions
- Networks of neurons, nuclei, circuits, cortical areas and systems of areas
- Different thoughts and experiences involve different parts of different networks
- Study is called Network Science



## Awareness of Self

- Certain areas have developed, related it seems to the emergence of language
  - These areas predict the future and predict what others are thinking
  - Gauge the personal and emotional importance of stimuli
  - Are associated with interpreting the thoughts and actions of others
- Medial Prefrontal Cortex – “I am the one doing this”
- Posterior Cingulate Cortex – Being ‘caught up’ in our thoughts, feelings, sensations
- Precuneus – Integration of perception of the environment

- Corballis MC 2013, Moran LM 2013, Cavanna AE 2006, Brewer J 2013, Kingsland J 2016





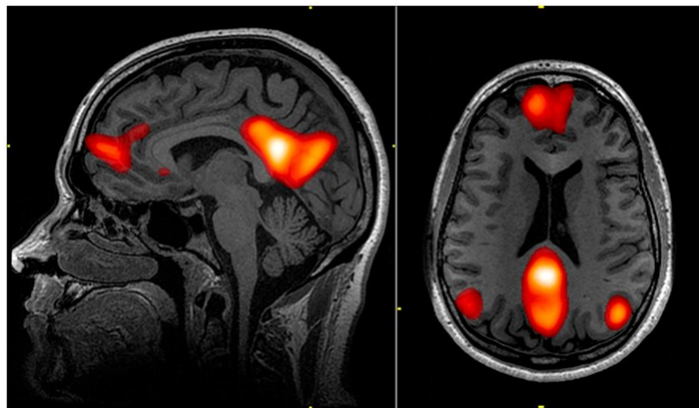
## Default Mode Neural Network

- A network of specific brain areas
  - Medial Prefrontal Cortex
  - Posterior Cingulate Cortex
  - Precuneus
  - And variously, Medial Temporal Lobe, Hippocampal Formation, Para hippocampal Cortex
- Activity is diminished in focused intentional activity
- Active (hyperactive) when idle
  - This is dysphoric (unpleasant)
    - May be what being “bored” is
- These Cortical Midline Structures are the location of the perception of self

• Shulman GI 1997, Jessica R 2012



## Default Mode Neural Network





## What Increases DMN Activity?

- Low dopamine - as in addiction
  - Restless, irritable and discontent
    - Reward Deficiency Syndrome (RDS)
- Stress
- Depression
- Anxiety
- Trauma

• Kuhn S 2011, Tomasi D 2009, Gold M 2020



## Genetics

- Play a part in the activity of the DMN
- Play a part in the risk for:
  - Addiction
  - ADHD
  - Depression
  - Anxiety
- Activity of the DMN is increased in addiction
- What if the risk for addiction **IS** the inherited increased activity of the DMN?
- What if the risk for other psychiatric illness **IS** the inherited increased activity of the DMN?

• Zhang 2019, Glahn 2010



## Hyperactive DMN

- Self-referential
- Focused on (survival) instincts
  - Overvalues activities to gratify desires (exaggerated, overvalued survival needs)
- Worries about deprivation
- Projects challenges from others
- Future trips – projects the future onto the now
- Performs mental simulations
  
- i.e., Self Centered!!
  - Fang 2021



## Self-Centeredness

- Always on the defensive
- Can't see the big picture for focus on self
- Imposing – see relationships as a tool for getting what they want
- Feel insecure and feel superior
- Opinionated – always right
- Hide behind success
- Chameleon like in relationships
- Egotistical
- Dictionary.com 2021



## Symptoms of Self-Centeredness

- Seven (11) deadly sins
  - Dishonesty
  - Resentment
  - Fear
  - Envy
  - Gluttony
  - Greed
  - Lust
  - Pride
  - Sloth
  - Wrath



## On Self

- The true value of a human being can be found in the degree to which he has attained liberation from the self.
  - **Albert Einstein**
- There is no self
  - **Buddha**



## The Use of Will

- Can will the experience of pleasure – not happiness
- Can will oneself to be meek – but not to be humble
- Can will yourself to go to bed - but not to go to sleep
  - Kurtz 1992
  
- Often the goals of spiritual health do not respond to direct action
- But paradoxically, those goals respond to efforts to reduce ego
- This may be the same thing as efforts to reduce the activity of the DMN
  - Rim 2019, Svob 2016, Raffone 2010



## What Reduces DMN Activity?

- Focused activity
- Dopaminergic experiences
  - Exercise, altruism (Prayer of St. Francis)
  - Dopaminergic drugs
    - Drugs of addiction for a while, then it gets worse
    - Some medications and nutrients
- Meditation
  - Concentrative
  - Open Monitoring (Mindfulness)
- Prayer
- Psychedelic drugs – psilocybin, ayahuasca
  - Tomasi 2009, Shulman GI 1997, McFadden 2013, Kyeong 2017, Garrison 2015



## What is Spiritual Health

- A sense of wellbeing
- Contentment with one's life circumstances
- Meaningfulness in one's life
- Ability to use one's highest abilities and strengths
- Community – a sense of belonging
- Transcendence
  - Religious transcendence
  - The transcendence of everydayness into the sphere of higher ideals and deep ideas, into the sphere of ethical and aesthetical values; it is oriented toward a deeper realization of being one's own self (i.e., authenticity) in the human community and the natural world, searching for the meaning of life

• Ghaderi 2018, Michaleson 2021, Sena 2021



## How Do You Get There

- Intentional pursuit of behavior that is different from instinctual self-centeredness
  - Love
  - Compassion
  - Tolerance
  - Forgiveness
  - Responsibility
  - Kindness
  - Altruism
  - Acceptance
  - Inclusion
- You can't will yourself to spiritual health
- But non-self-centered action will get you there, if it's honest
  - "Act yourself into right thinking"
- Rim 2019, Kyeong 2017



## Prayer and Meditation

- Often embrace right living
    - Loving kindness
    - Selflessness
  - Concentrative meditation
    - Focus on one thing – breath, pulse, mantra
  - Open monitoring meditation
    - Mindfulness, focus with curiosity on what is happening in the precise moment
  - Prayer
    - Asking for guidance, right action, grace
- Rim 2019, Kyeong 2017



## Effects on the DMN

- In studies of experienced meditators for instance
  - The main nodes of the default-mode network (medial prefrontal and posterior cingulate cortices) were relatively deactivated in experienced meditators across all meditation types.
  - Functional connectivity analysis revealed stronger coupling in experienced meditators between the posterior cingulate, dorsal anterior cingulate, and dorsolateral prefrontal cortices (regions previously implicated in self-monitoring and cognitive control), both at baseline and during meditation.
    - Brewer 2011



## Psychedelics

- Psilocybin and ayahuasca reduce activity of DMN
- The experience is reported to be intensely spiritual
- Could we achieve spirituality through chemistry?
  - The experience of the 60s and 70s say no.
  - But experiments in long term meditators describe lasting benefit
- Carhart-Harris 2012



## Bottom Up - Top Down

- Bottom up spiritual experience
  - Psychedelics, biofeedback
    - Experimental
    - Not likely lasting alone
    - Decreases activity of DMN
- Top down spiritual practices
  - Prayer, meditation, loving kindness
    - Available, natural, proven
    - Lasting
    - Decreases activity of DMN





## Neurobiology of Spiritual Practice

- The DMN quietens
  - We are less concerned about the future
  - We are less demanding of ourself
  - Our needs trump our wants
- Other brain structures become active
  - Salience Network
    - Insula and Anterior Cingulate Cortex – interoception – empathy, emotional awareness
    - Lateral temporal gyrus - transcendence
    - Right Amygdala Gyrus – emotional memory
- Without the intrusion of the DMN, other brain areas related to altruism and empathy become ascendant and spirituality becomes more accessible
  - Sharp 2018, Craig 2009, Sevnic 2017,



## What This Means

- If we engage in the things that reduce the activity of the DMN we can realize:
  - Acceptance of self
  - Love for others
  - Emotional comfort
  - Connection with the transcendent
- Spirituality is the result of intentional, repetitive practices
- Changes can be lasting
- Positive impact on symptoms of psychiatric illness



## Why it is important

- Understanding spirituality as biology, without a necessity for beliefs or dogma, can give us a different reason to be spiritual
  - Self centeredness is uncomfortable and associated with psychopathology
  - Self-centeredness causes and is caused by hyperactivity of the Default Mode Network
  - A lifestyle that involves loving kindness, acceptance, gratitude and prayer/meditation reduces the activity of the Default Mode Network
  - Meditative and other practices that reduce the activity of the Default Mode Network improve health, happiness and wellbeing



## For a Copy of These Slides

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