

# THE BRAIN & SPIRITUALITY

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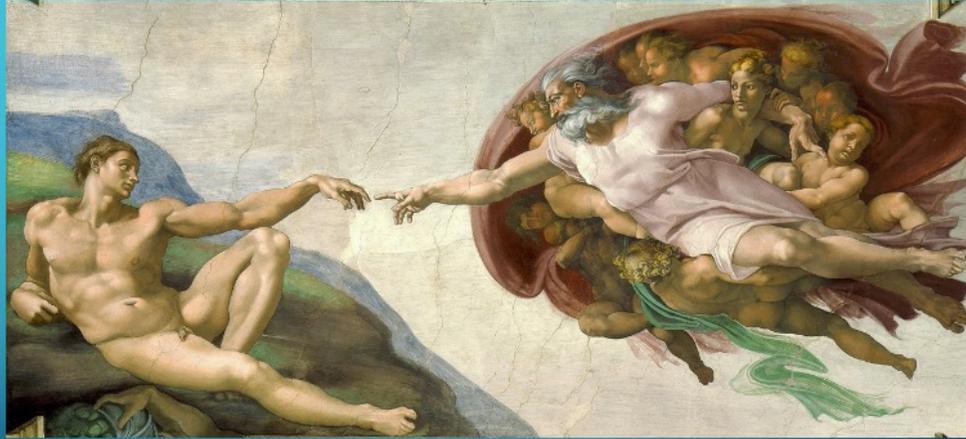
APRIL 11<sup>TH</sup>, 2021

## DISCLOSURES

- I am not a medical doctor
- I am \*almost\* a neuroscientist
- Background in Psychology
- Studying Behavioral Neuroscience for 5 years now, and will graduate with a PhD from Boston University's School of Medicine in September
- All the work presented today is not my own, but the work of other neuroscientists in the field of Neurotheology



Neurotheology is the relationship between the brain and our spiritual or religious self, also called Spiritual Neuroscience



The Creation of Adam by Michelangelo

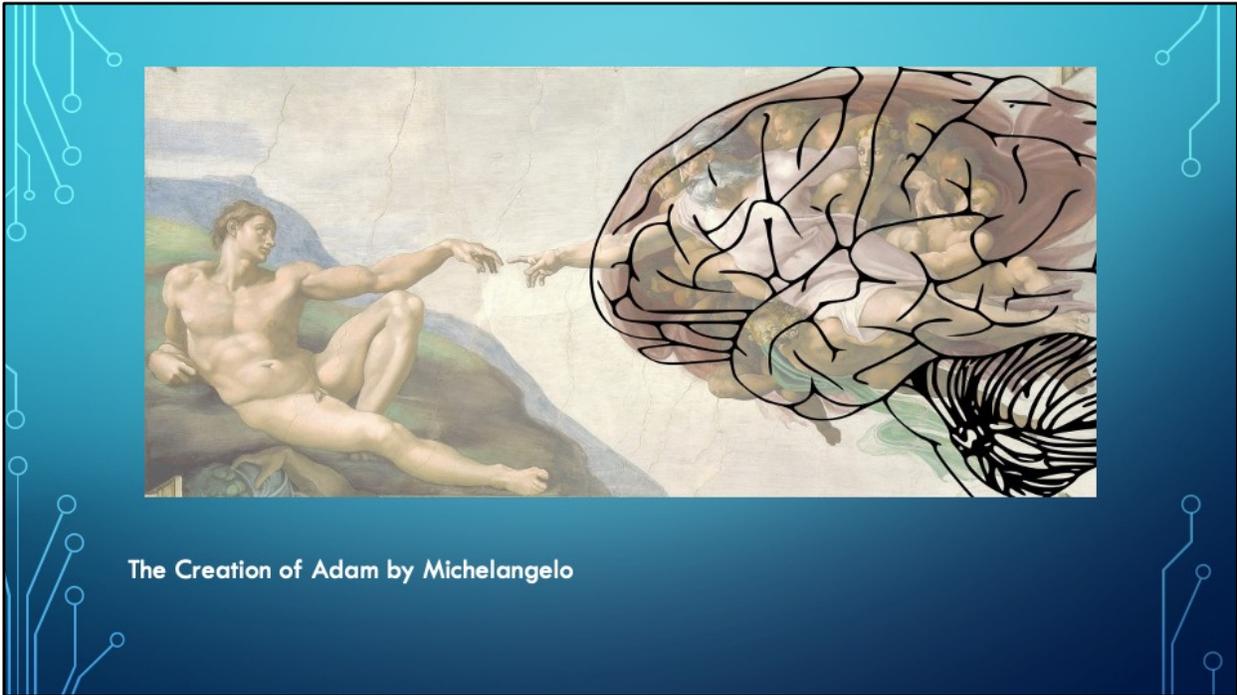
Here we have, one of the most famous paintings by Michelangelo in the Sistine Chapel called the Creation of Adam, depicting the moment God created humankind. It is one of a series of paintings on the ceiling that give life to the story in Genesis.

There are many intriguing theories surrounding Michelangelo's work about hidden pictures or meanings within the paintings. However, critics say it is the result of people seeing what they want to see and often point out that Michelangelo left a vast record of his life in writing, none of which mentions secret messages or hidden meanings.

But what if Michelangelo understood a deeper meaning to the story of creation? Rather than leaving obscure messages in bits of artwork, what if the entire painting was a literal representation of creation?

On first glance the painting may represent the biblical story and on reflection what if it reveals an underlying truth?

What are your thoughts or reactions to this painting, and what if any hidden or secret messages do you think are in here? What about this red cloud that God resides on?



The Creation of Adam by Michelangelo

And where does god reside in the painting? Right within this shape of the human brain.

God, as represented in the painting via his position in the 'brain', is within us

Michelangelo's painting is that God is bestowing Adam with the gift of the intellect and that it is by using this great gift that man may reach his highest potential and bring all things his mind develops into creation.

## RELIGION/SPIRITUALITY & HEALTH

- Religious beliefs and commitments have been shown to help people:
  - Cope with stressful live events
  - Lower levels of anxiety about death
  - Increase levels of life satisfaction
  - Lower risk of developing depression and anxiety
- Even minimal religious participation is correlated with enhancing longevity and personal health.



Findings from Gaw et al. 2019; Rim et al. 2019

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### But what about brain health?

There was a recent paper, in 2019, that combined all of the research studies to date looking at religious and spiritual involvement on cognitive function (and cognitive function means things like memory and attention, problem solving etc), and they found that:

## RELIGION/SPIRITUALITY & HEALTH

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### But what about brain health?

- 82% of research has reported positive associations between religious involvement, spirituality, and brain health (Hosseini et al. 2019)

82% of research thus far has reported positive associations between religious involvement, spirituality, and brain health.

It appears that religious and spiritual involvement is protective against cognitive decline in middle and older adults. And I'll talk more about this later on. But the problem really is, what does religious involvement and spirituality MEAN?

## RELIGIOUS INVOLVEMENT & SPIRITUALITY

- Is it the length of time you spend in church, or how often you go?
- Does it matter what denomination you attend?
- Going to church might involve communion, singing, chanting, praying, tithing, talking with other members, reading scriptures, or volunteering in charitable work.
  - What activity has an impact on the brain?
    - Some of them? All of them? Or a specific combination?



Now, one can argue that the beneficial effects are attributable to any form of social group interaction. They provide social involvement as well as a sense of purpose and meaning, variables that are essential for everyone's psychological health.

What are some other characteristics about religion or spirituality that you think might directly impact brain health?

## MEDITATION & PRAYER

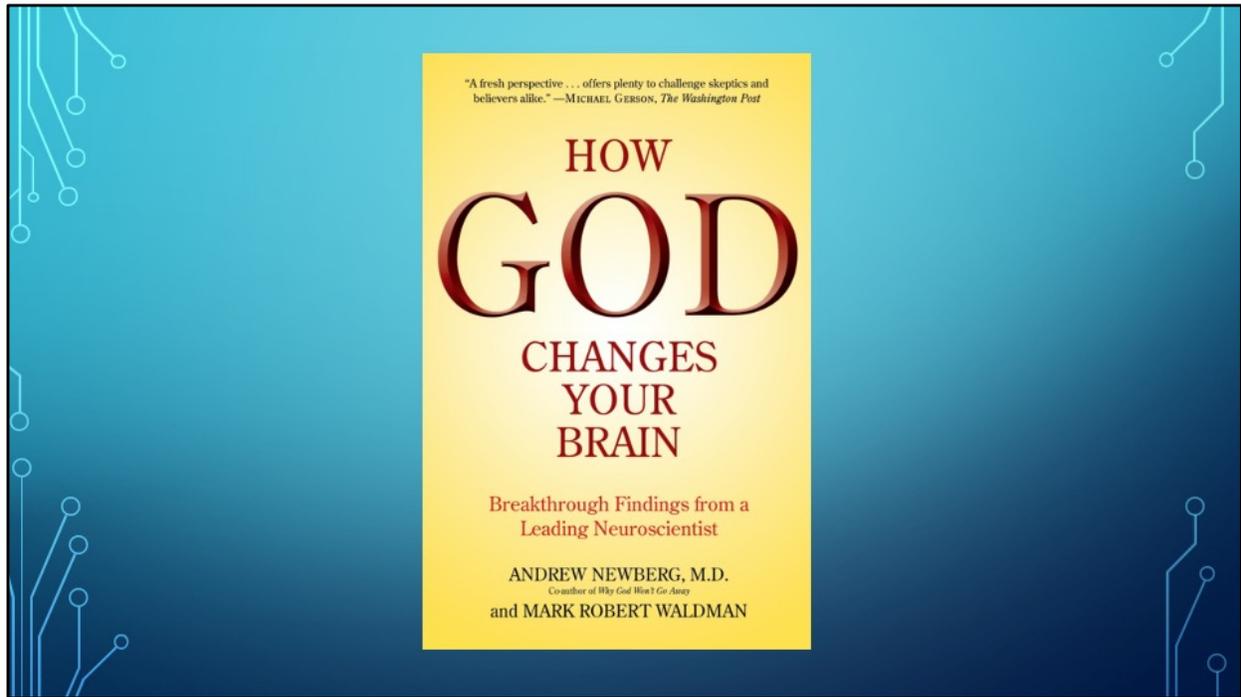
- Can permanently strengthen neural functioning in specific parts of the brain that are involved with:
  - Lowering anxiety and depression
  - Enhancing social awareness and empathy
  - Improving cognitive and intellectual functioning



**There are approximately 20 references to meditation in the bible**  
Genesis 24:63, Joshua 1:8, Psalm 1:2, Psalm 5:1, Psalm 19:14, Psalm 49:3, Psalm 63:6, Psalm 77:12, Psalm 104:34, Psalm 119:15, Psalm 119:23, Psalm 119:48, Psalm 119:78, Psalm 119:97, Psalm 199:99, Psalm 119:148, Psalm 143:5, Isaiah 33:18, Luke 21:14, and 1 Timothy 4:15

Repeating a new task, such as meditation or prayer, changes the activity at the end of a neuron, which is nerve cell within the brain, and will eventually change the structure of the cell.

We're going to dive deeper into the neurobiology of meditation and prayer and how that can positively impact your brain health.



So the majority of what I'm going to be discussing today can be found in this book, How God Changes your Brain by Dr. Andrew Newberg and Mark Robert Waldman. Dr. Newberg is a prominent neuroscientist in not only religious studies but also in brain aging. So if you are interested in learning more about the brain and God I would recommend checking out this book.

## THE SCIENCE OF GOD

- The more you think about God, the more you will alter the neural circuitry in specific parts of your brain.
- Neuroscience cannot tell you if God does or doesn't exist.



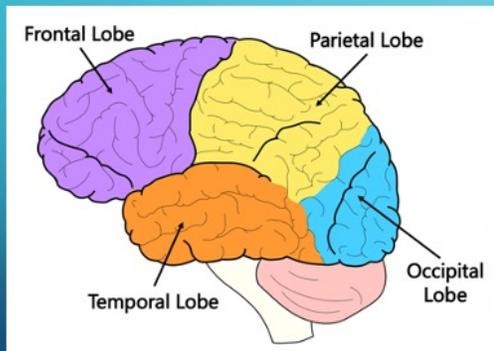
From a neurological perspective, God is a perception and an experience that is constantly changing and evolving in the human brain.

This is similar to some of the studies that you might have read about professional musicians, who after years and years of immense practice, have larger brain structures than amateur musicians. The brain is malleable, meaning the more you use and strengthen certain connections, the more your brain changes.

And we will review the specific parts of the brain that are of interest in just a few seconds.

The human brain does not even worry if the things we see are actually real. It only need to know if they are useful for survival, and as you will see in the next couple of slides, religion, spirituality, and more specifically meditation are certainly useful for survival.

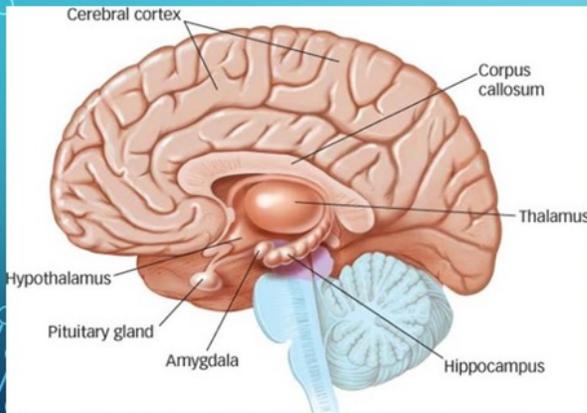
## NEUROANATOMY 101



- Frontal Lobe – logic, reason, attention, language skills, and voluntary motivation
- Parietal Lobe – sense of yourself in relation to other objects in the world

This is a drawing of the neocortex or the cerebral cortex of the brain, and this is where all the memories, beliefs, and behaviors you have learned over a lifetime are stored, along with all of your visual, auditory, motor, language, and cognitive processing centers of the brain. 30% of the cerebral cortex is the frontal lobe, which is depicted here in purple: This lobe sits directly behind your eyes, it controls nearly everything you are conscious of. Creates and integrates all your ideas about God, positive or negative, including the logic you use to evaluate your religious and spiritual beliefs. It predicts your future in relationship to God and attempts to intellectually answer all the “why, what, and where” questions raised by spiritual issues. Parietal lobe, which is the one in yellow here is located above and slightly behind your ears. When activity in this part of the brain decreases, you can feel at one with God, the universe, or any other concept you are consciously focusing on. There are also a couple of “God Circuits” as Dr. Newberg likes to call them: One of these is the occipital parietal circuit, so information that is passing between those two lobes, identified in yellow and blue here. This circuit identifies God as an object that exists in the world. The parietal-frontal circuit establishes a relationship between the two objects known as “you” and “God”. places God in space and allows you to experience God’s presence.

## NEUROANATOMY 101



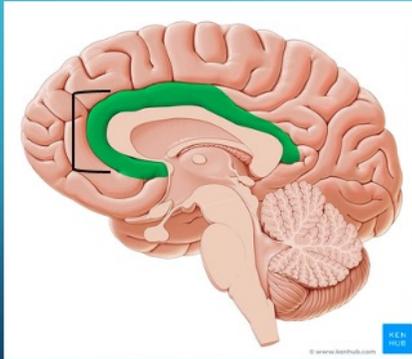
- Amygdala – fight or flight response to perceived or imagined fear
- Thalamus – sends sensory info to all the other parts of the brain
- Limbic System – memory encoding, emotional response

Amygdala – fight or flight response to fear.

Thalamus – gives emotional meaning to your concepts of God

Limbic system – oldest part of the brain that every reptile, fish, amphibian, bird, and mammal has. Involved in memory encoding, emotional responses, and many other bodily functions.

## NEUROANATOMY 101



- Anterior Cingulate – social awareness, intuition, empathy
- **Spiritual practices specifically strengthen the anterior cingulate**

The final brain region of interest for us today is the Anterior Cingulate. So, the cingulate cortex is in green here, and the anterior part is what is in the bracket. The anterior cingulate is involved in social awareness, intuition, and empathy. Allows you to experience God as loving and compassionate. decreases religious anxiety, guilt, fear, and anger by suppressing activity in the amygdala. And this is the part of the brain that spiritual practices and meditation strengthen and activate: And when this happens, activity in the amygdala slows down. And to remind you again the amygdala is kind of the emotional reactivity center of the brain, involved in the fight or flight response to fear and stress. A lot of the neuroscientific research surrounding religion and spirituality focuses on compassion and empathy, and these functions appears to mostly reside in the anterior cingulate. Prior studies have shown that if you have a larger or more active anterior cingulate, you may experience greater empathy., and you'll be far less likely to react with anger or fear. When you intensely and consistently focus on your spiritual values and goals, you increase the blood flow to your frontal lobes and anterior cingulate, which causes the activities in emotional center of the brain to decrease.

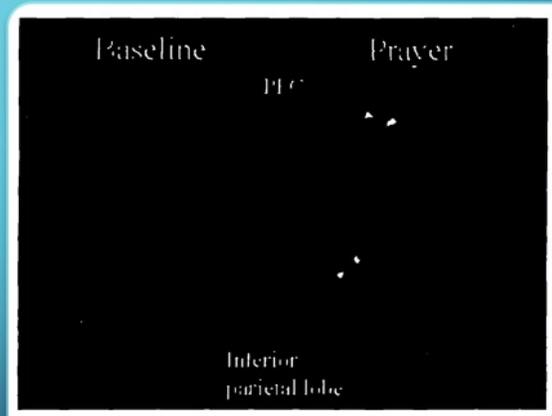
## NEWBERG ET AL. 2003

- Investigated cerebral blood flow during different types of meditative practices.
- 3 Franciscan nuns
  - Each had performed more than 15 years of daily practice
  - Performed the “centering prayer”
- Measured cerebral flow at rest, and then again during active meditation.

Centering prayer requires you to focus attention on a phrase from the Bible or prayer over a period of time with the goal of “opening themselves to being in the presence of God”

## NEWBERG ET AL. 2003 RESULTS

- While performing verbal meditation, the nuns showed increased blood flow in the prefrontal cortex, inferior parietal lobes, and the inferior frontal lobes.
- Inverse correlation between the blood flow in the prefrontal cortex and the parietal lobes, such that increased blood flow in the parietal lobe was associated with decreased blood flow in the prefrontal cortex.



So this article was back in 2003, when the brain imaging technology was just starting to come around, so the pictures aren't that pretty. So let me walk you through this:

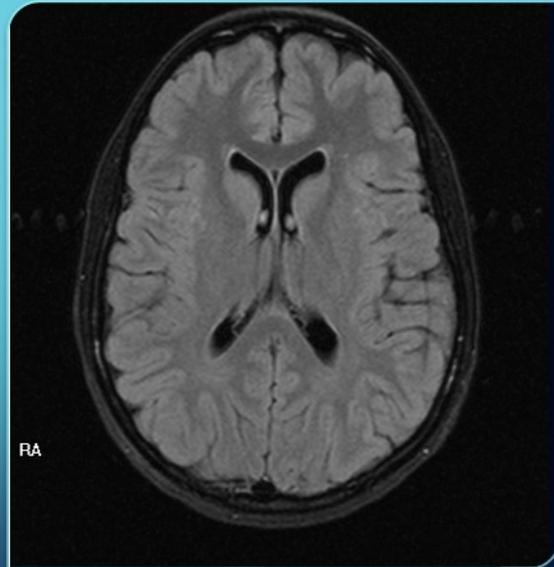
So here what we are looking at are two separate brain scan images, one on the left is the brain at rest, so when the nuns aren't actively meditating just a rest, we don't see any areas of high cerebral blood flow, which is normal. Now, the image on the right is an image during active meditation and the white dots signify increased blood flow.

So just to orient you here, we are looking at a slide of the brain as if you were looking down on the top of the brain, like this:

So again this study indicated that meditative practices activate both the frontal and parietal lobes which are involved in the conscious awareness of God, and the personal relationship between you and God.

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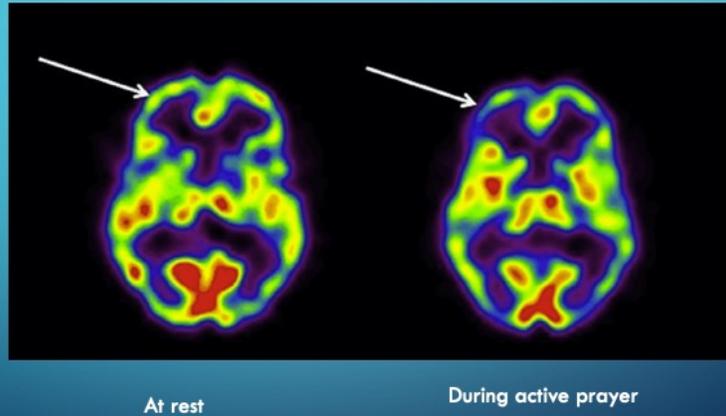
Example brain scan to compare to the previous slide.

## NEWBERG ET AL. 2015

- Three Islamic individuals practicing two different types of Islamic prayer
  - Dhikr – incorporates chanting, prayer, meditation, and various ritual movements with the overall purpose to remember and embrace the spirit of God
  - Salat – prayers performed each day at specific times as specified in the Quran.
    - Focuses on surrendering to God and feeling God's love and compassion.

This is a newer study, using more advanced brain techniques and focuses on Islamic prayer, which has a specific emphasis on surrendering yourself to God, which is quite different from the study we just review which is more attentional and focuses on specific scriptures and things like that. And we can actually see the differences in the types of prayers in the brain function as well.

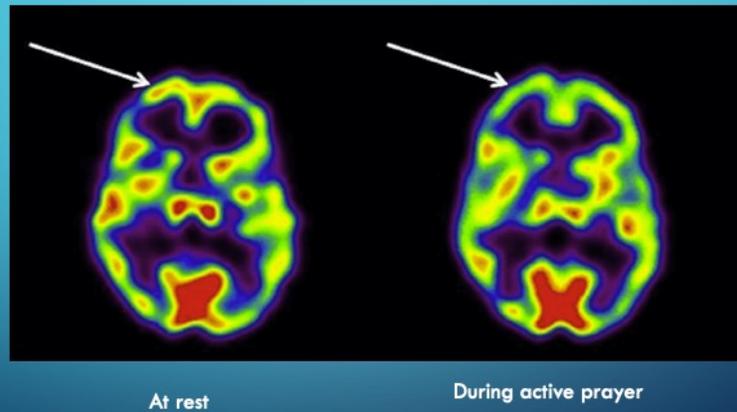
## NEWBERG ET AL. 2015 RESULTS



Scan on the left shows at rest. Areas that look “hotter” or are more red indicate areas that are more active.

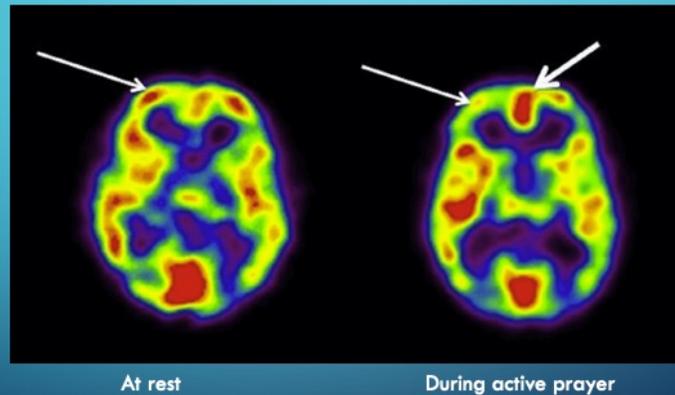
And the scan on the right is during active prayer, and what we can see here is decreased frontal lobe activity during intense prayer.

## NEWBERG ET AL. 2015 RESULTS



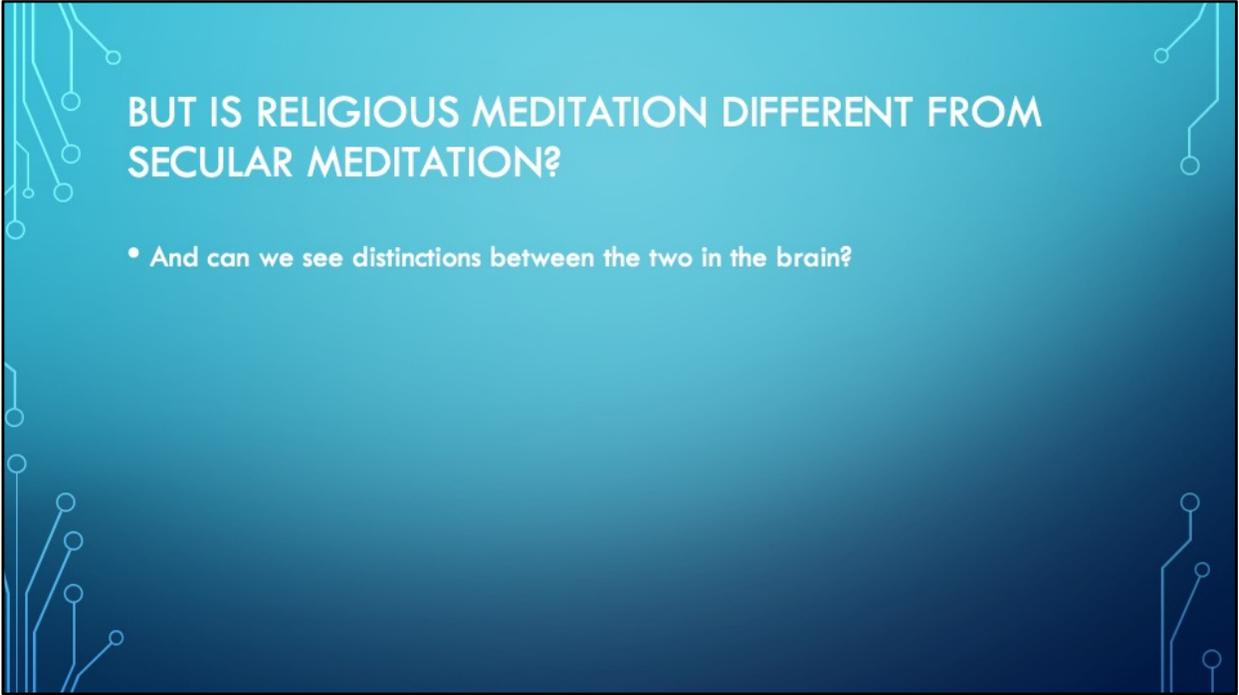
And again here similar in a second participant

## NEWBERG ET AL. 2015 RESULTS



In this one we see decreased frontal lobe activity, and we also see increased anterior cingulate activity, which again is the brain area I mentioned earlier that seems to be specifically strengthened by meditative and prayer practices and is involved in feeling compassion and empathy.

Of note, all three of these people reported experiencing a sense of surrender and lack of personal, willful control, which explains the decrease in activity within the frontal lobes, as the frontal lobes like to control basically everything.



## BUT IS RELIGIOUS MEDITATION DIFFERENT FROM SECULAR MEDITATION?

- And can we see distinctions between the two in the brain?

What do you think?

And if so what is different?

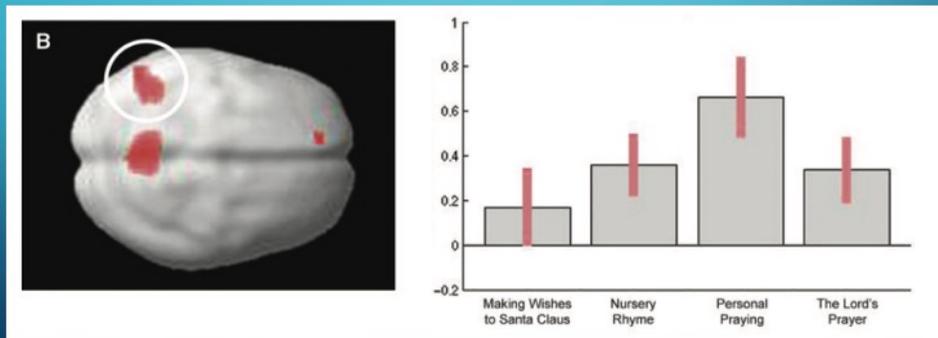
Answer: Prayer focuses on others, or a relationship social relationship with god!

## SCHJOEDT ET AL. 2009

- 20 young healthy volunteers (mean age was 25 years old)
  - 6 men and 14 women
  - Belong to the Danish Lutheran Church – known for its orthodox view on Christian conduct.
    - Exclusive use of orthodox prayers like the Lord's Prayer
- 4 different conditions
  - 2 religious
    - Highly formalized speech act: The Lord's Prayer
    - Improvised speech act: personal prayer
  - 2 secular
    - Highly formalized speech act: Nursey Rhyme
    - Improvised speech act: wishes to Santa Claus
- Tasks were performed silently as internal speech with eyes closed during the brain scan.

## SCHJOEDT ET AL. 2009 RESULTS

- 4 regions of the brain that were activated MOST by personal praying
  - Precuneus, temporo-parietal junction, anterior medial prefrontal cortex, temporopolar region



A specific pattern of neural activity in Personal Praying relative to Making Wishes to Santa Claus consisting of the temporo-parietal junction, the temporopolar region, the anterior MPFC and the precuneus. The temporo-parietal junction has been reported to be involved in social cognition. Actually all four of these regions are thought of as the classic “theory of mind” areas. So this pattern of activation in personal praying suggests that talking to God, who is considered “real” rather than “fictitious” like santa claus, is comparable to normal interpersonal interaction. I’ll also point on the difference in activation in these areas between the personal praying and rehearsing the Lord’s prayer: highly formalized prayers usually consist of frequently rehearsed, abstracted and non-personal content. Indeed, more than one of the participants warned them in pre-scan interviews that The Lord’s Prayer had become so practiced that it probably would not give us any results at all. Contrary to reciting The Lord’s Prayer, personal praying consists of improvised and direct conversations with God about personal problems and requests. In this form of praying mentalizing, social reciprocity, autobiographical memory and updating of social narratives are much more relevant features. Thinking of ordinary facts relies more on memory retrieval networks, whereas thinking about religious matters relies more on brain regions that govern emotion, self-representation, and cognitive conflict.

## ADDITIONAL MEDITATION STUDIES:

- Advanced meditators had a higher levels of parietal activity when they were not meditating.
  - Meditation, over time, strengthens one sense of self in relationship to the world, as well as to the spiritual dimensions of life.
- Contemplative practices stimulate activity in the **anterior cingulate**, thus helping a person to become more sensitive to the feelings of others.
  - Meditating on any form of love, including God's love, appears to strengthen the same neurological circuits that allow us to feel compassion toward others.
  - Make us more sensitive to the suffering of others, which may explain why those traditions that emphasize meditation are often involved in community charities and peacekeeping ventures.

Findings from Newberg et al. 2006; Lamm et al. 2007; Singer 2007; Seitz et al. 2006

## KAUFMAN ET AL. 2007

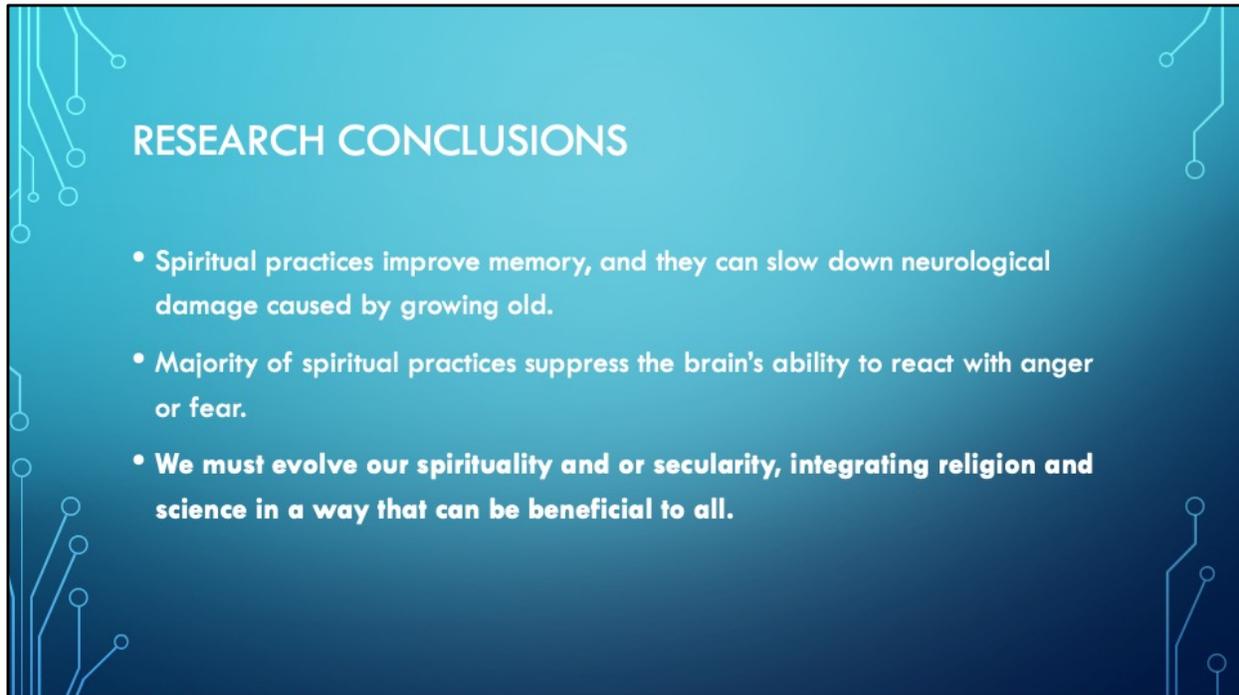
- The impact of spirituality & religiosity on cognitive decline in Alzheimer's Disease
- 70 participants, ages 49-94
  - All met criteria for having probable Alzheimer's Disease
  - Looked at their cognitive function over the course of 1 year
- Assessment of Spirituality & Religiosity
  - Attendance (frequency of attending a religious meeting)
  - Private Religious Practice (frequency of spending time in private religious activities)
  - Intrinsic Religiosity (questions about religious belief or experience)
  - On a scale from 1 (low) to 4 (high) how religious/spiritual are you?

Alzheimer's disease is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills and, eventually, the ability to carry out the simplest tasks. And it's the most common causes of dementia in older adults.

## KAUFMAN ET AL. 2007 RESULTS

- The more spiritual a person rated themselves as being, the less cognitive decline they showed over the course of a year.
- Higher frequency of private religious activities was associated with less cognitive decline.
- **Higher levels of private religious activities and of spirituality predict slower cognitive decline in patients with Alzheimer's Disease**

This may be because religion/spirituality is often associated with better health behaviors, or could it simply be the meditative aspect?



Meditation can help maintain a healthy structural balance that will slow the aging process.

As we also just reviewed with the different meditation/prayer studies, these practices increased or strengthen areas of the brain that help to quiet down or turn off the stressor/anger parts of our brain, which leads to better physical and emotional health in the long run.

One of the take home messages that I really wanted to get across was that those practice medicine or mental health advocates basically anybody that in the business of healing people, need to really take into account spirituality. And we need to be more open in integrates both spirituality and science, in a way that could potentially be beneficial to all.

## FAITH

- Faith is essential for maintaining a healthy brain, but if you exclude exercise and companionship, you are going to cripple your health.
  - Nurture all three, and if religion is high on your list, then include meditation, since it appears to be the best way to make spiritual values neurologically real.



## SPIRITUAL FITNESS - KHALSA & NEWBERG (2021)

- An interweaving of basic, psychological, and spiritual well-being
- Developed through meditation exercises
- Over-arching theme is connection: with self, others, and/or God
  - Relating to God in one's own way is most important for spiritual well-being
- Used to help moderate life stressors and soften their effects on mental and physical health

Spiritual well-being: a subjective experience of the deepest values and meanings by which people live.

## SPIRITUAL FITNESS - KHALSA & NEWBERG (2021)

- **Basic Well-Being**
  - Career, social, financial, physical, and community
- **Psychological Well-Being**
  - Acceptance, self-esteem, independence, persistent personal growth, positive relationships with others, purpose in life
- **Spiritual Well-Being**
  - Patience, awareness, compassion, surrender

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**\*Work on achieving these things through 12 minutes of meditation a day!\***

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