

## The Brain in the Quran

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1. **Abstract**
2. **Introduction**

The Quran revealed by God Himself more than 1400 years ago is a holy book for all muslims of the world. This book is considered as a miracle given by God to the humanity. Today on, many scientific facts have been discovered and lots of links related to the Quran has been made. However, one element has not been understood. Why the Quran did mention the heart so many time but not the brain ? Especially when we know that the first mature organ in the development is the heart and the last one is the brain. These two organs are scientifically proven to be the key organs for humans. Since the heart is involved in the sustaining of the hole body by sending the blood in all organs, the brain is involved in the control of all these through nervous impulses.

After meditating on the Quran's verses, we can easily see that the words « qalb » and « fou'ad » are generally translated as heart. However, these two different words are always mentioned in different contexts.

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Assuming that God doesn't use different words without any precise aim, we have to investigate what is the difference between these two words.

This work will focus on the word « fu'ad » mentioned 16 times in the Quran. Since the word « qalb » is used, even in a medical point of view, to describe the heart, we hypothesised that the word « fu'ad » could be the brain. Through this work, we will try to demonstrate this hypothesis according to the context of this word, the translation of the surrounding words and the scientific literature. If the word « fu'ad » was meant to describe the brain, the description of this word in the Quran should correlate with the scientific literature as well as the meaning of the surrounding words. Furthermore, we have to mention that this work is made only for a better understanding of the Quran and not for any other purpose.

### 3. Method

1. The Quran : The basics of this work are provided by the Quran. The methodology is to use the verses where the word « fu'ad » appears and to analyse the key words of the corresponding verses as well as, in some cases, the key words of the surrounding verses to understand the context of the targeted word. A translation will be then proposed.
2. Almaany Dictionnary : This complete dictionnary will be used to find the translation of the words surrounding and describing the word « fu'ad ».
3. Pubmed (scientific literature) : This support will be used to understand the scientific knowledge behind the proposed understanding of the verses containing the word « fu'ad ».

### 4. Discussion

#### SurahAl-Anaam, Verse 110:

وَنُفِّلْنَا بَنَاتَهُمْ وَأَبْصَارَهُمْ كَمَا لَمْ يُؤْمِنُوا بِهَا وَلَمْ يَرْوُدُوا لَهَا فِيهَا تَهْمِيْعَمَهُ

**Oua nouqallibou 'af'idatouhoum oua absarahoum kama lam you'minou bihi aouala marratan oua nadharouhoum fi toughianihim ya3mahoun**

- 'af'idatouhoum coming from fu'ad is the targeted word
- Nouqallibou coming from qalb could mean : long lasting change
- Absarahoum coming from basar could mean : meditation
- Nadharouhoum coming from nadhra could mean : to dedicate oneself to something
- Toughianihim coming from tagha could mean : to be unjust
- Ya3mahoun coming from 3amah could mean : to wander

#### Proposed literal translation :

And We induce long lasting changes in their brains and their meditations as if they do not believe with it the first time and they wander intheir dedication of the injustice.

#### Proposed translation :

And We generate long-term changes in their prefrontal cortexes and thus in the way they meditate, it is like if they never believed before with it and they keep dedicate themselves to the injustice.

#### Scientific link :

**Meditation experience is associated with increased cortical thickness**, Sara W. Lazar et al., 2005

« Previous research indicates that long-term meditation practice is associated with altered resting electroencephalogram patterns, suggestive of long lasting changes in brain activity. We hypothesized that meditation practice might also be associated with changes in the brain's physical structure. Magnetic resonance imaging was used to assess cortical thickness in 20 participants with extensive Insight meditation experience, which involves focused attention to internal experiences. Brain regions associated with attention, interoception and sensory processing were thicker in meditation participants than matched controls, including the prefrontal cortex and right anterior insula. Between-group differences in prefrontal cortical thickness were most pronounced in older participants, suggesting that meditation might offset age-related cortical thinning. Finally, the thickness of two regions correlated with meditation experience. These data provide the first structural evidence for experience-dependent cortical plasticity associated with meditation practice. »

#### Surah Al-Anaam, Verse 113:

وَلِتَصْغَبَ إِلَيْهَا قُدَّةَ الدِّينِ لِيُؤْمِنُوا بِهَا آخِرَ قَوْلٍ صَوَّهُوا لِيَقْتَرُوا مَا هُمْ قَاتِرُونَ

**Oua litasgha ilayhi af'idatou alladhina la you'minouna bil'akhirati oulyardaouhou oualyaqtarifou ma houm mouqtarifoun**

- af'idatou coming from fu'ad is the targetted word.
- Litasgha coming from sagha could mean : to shape.
- Oualyardaouhou coming from rida could mean : consent
- Oualyaqtarifou and mouqtarifoun coming from qarafa could mean : to comit

**Proposed literal translation :**

And to shape toward Him the brain of those who do not believe in the afterlife and that they will consent with it and they comit what they are comitting.

**Proposed translation :**

And to shape the believing part of the prefrontal cortex of those who do not believe in the afterlife, and they will recognize it even if they are doing what they are doing.

**Scientific link :**

**Highly religious participants recruit areas of social cognition in personal prayer**, Uffe Schjoedt et al., 2009  
« ...The Lord's Prayer showed massive activations in the right dorsolateral prefrontal cortex, the right parietal cortex, left cerebellum, and in the posterior part of the inferior temporal cortex... »

**Surah Hud, Verse 120:**

وَمِنِينَ وَكُلًّا نَقُصُّ عَلَيْكُمْ نَبَأَ الرُّسُلِ أَنْتَبْتَهُمْ أَذْكَرَ جَاءَ كَفِيهِمْ هَذَا الْحَقُّ مَوْعِظَةً وَذِكْرًا لِلْمُنِ

**Oua koula naqoussou 3layka min 'anba'y alrousouli ma nouthabitou bihi fou'adaka oua ja'aka fi hadhihi alhaqqou oua maou3dhatoun oua dhikra lilmou'minin**

- Fou'adaka coming from fu'ad is the targetted word
- Nouthabitou coming from thbbata could mean : to consolidate
- Maou3dhatoun coming from maou3idhah could mean : lesson
- Dhikra coming from dhikr could mean : glory

**Proposed literal translation :**

And all we tell you about the news of the messengers aims to consolidate your brain and has come to you from this the truth and a lesson and a glory for the believers.

**Proposed translation :**

And all the novels of the messengers that we tell you aim to strengthen your prefrontal cortex, in which comes the truth and a lesson as well as a glory for the believers.

**Scientific link :**

**Effects of storytelling on the childhood brain: near-infrared spectroscopic comparison with the effects of picture-book reading**, Myiuk Yabe et al., 2018

In children, storytelling provides many psychological and educational benefits, such as enhanced imagination to help visualize spoken words, improved vocabulary, and more refined communication skills. However, the brain mechanisms underlying the effects of storytelling on children are not clear. In this study, the effects of storytelling on the brains of children were assessed by using near-infrared spectroscopy (NIRS). Results indicated significant decreases of the blood flow in the bilateral prefrontal areas during picture-book reading when the subjects were familiarized in comparison to the cases of the subject naïve to the stories. However, no significant differences in the blood flow were found during storytelling between the subjects naïve and familiarized to the stories. The results indicated more sustained brain activation to storytelling in comparison with picture-book reading, suggesting possible advantages of storytelling as a psychological and educational medium in children.

**Reflected glory and failure: the role of the medial prefrontal cortex and ventral striatum in self vs other relevance during advice-giving outcomes**, Dean Mobbs et al., 2015

Despite the risks, people enjoy giving advice. One explanation is that giving beneficial advice can result in reflected glory, ego boosts or reputation enhancement. However, giving poor advice can be socially harmful (being perceived as incompetent or untrustworthy). In both circumstances, we have a vested interest in the advice follower's success or failure, especially when it reflects specifically on us compared with when it is diffused between multiple advisors. We examined these dynamics using an Advisor-Advisee Game, where subjects acted as an Advisor to a confederate Advisee who selected one of the three options when trying to win money: accept the

subject's advice, accept the advice of a second confederate Advisor or accept both Advisors' advice. Results showed that having one's advice accepted, compared with being rejected, resulted in activity in the ventral striatum—a core reward area. Furthermore, the ventral striatum was only active when the subject's advice led to the advisee winning, and not when the advisee won based on the confederate's advice.

Finally, the medial prefrontal cortex (MPFC) was more active when the Advisee won or lost money based solely on the subject's advice compared with when the second Advisor's advice was accepted. One explanation for these findings is that the MPFC monitors self-relevant social information, while the ventral striatum is active when others accept advice and when their success leads to reflected glory.

#### Surah Ibrahim, Verse 37:

وَنُرَبِّاَلْبُقِيمُوا الصَّلَاةَ فَاَجْعَلْ فِدَةً مِّنَ النَّاسِ تَهْوِي اِلَيْهِمْ وَاَرْزُقْهُمْ مِّنَّا تَمْرًا اَتْلَعُوْهُمِشْكُرًا رَبَّنَا اِنَّا سَاكِنُوْا اِيْنِيْ وَادْعُرْ ذُرِّيْرًا عِنْدَ بَيْتِكَ الْمَحْرَمِ

Rabbana inni 'askantou min dhourryiati biouadin ghayri dhi zar3in 3inda baytika almou7arrami

Rabbana liouqymou alssalata faj3al 'af'idatan mina alnasi tahoui ilaihim ouarzouqhous mina althamarati la3allahoum yachkouroun

- 'af'idatan coming from fu'ad is the targetted word
- Tahoui coming from haouya could mean : to affectionnate

#### Proposed literal translation :

Lord I shelta a part of my descendants in a valley which has no plant next to your holy house Lord so that they could pray so manage brains among the people to affectionnate them and give them some fruits that they will thank you.

#### Proposed translation :

Oh Lord I shelta a part of my descendants in a valley that has no plant next to your holy house, Oh Lord so they could pray, thus manage prefrontal cortexes among the people in order that You will affectionnate them, and give them some of knowledge to let them be thankful.

#### Scientific link :

**Neural correlates of gratitude**, Glenn R. Fox et al., 2015

Gratitude is an important aspect of human sociality, and is valued by religions and moral philosophies. It has been established that gratitude leads to benefits for both mental health and interpersonal relationships. It is thus important to elucidate the neurobiological correlates of gratitude, which are only now beginning to be investigated. To this end, we conducted an experiment during which we induced gratitude in participants while they underwent functional magnetic resonance imaging. We hypothesized that gratitude ratings would correlate with activity in brain regions associated with moral cognition, value judgment and theory of mind. The stimuli used to elicit gratitude were drawn from stories of survivors of the Holocaust, as many survivors report being sheltered by strangers or receiving lifesaving food and clothing, and having strong feelings of gratitude for such gifts. The participants were asked to place themselves in the context of the Holocaust and imagine what their own experience would feel like if they received such gifts. For each gift, they rated how grateful they felt. The results revealed that ratings of gratitude correlated with brain activity in the anterior cingulate cortex and medial prefrontal cortex, in support of our hypotheses. The results provide a window into the brain circuitry for moral cognition and positive emotion that accompanies the experience of benefitting from the goodwill of others.

#### Surah Ibrahim, Verse 43:

مُهْطِعِيْنَ مُقْتَعِرٍ ؕ وَسِيْهَمًا لَّا يَرْتَدُّ اِلَيْهِمْ طَرْفُهُمْ وَاَفْتَدَتْهُمْ هَوَا

Mouhti3ina mouqna3i rou'ousihim la yartaddou ilayhim tarfouhoum oua 'af'idatouhoum haoua'

- 'af'idatouhoum coming from fu'ad is the targetted word
- Mouqna3i coming from qana3a could mean : convinced
- Rou'ousihim coming from ra's could mean : head
- Yartaddou coming from rada' could mean : to respond
- Tarfouhoum coming from tarf could mean : organ
- Haoua' coming from haoua could mean : partial

#### Proposed literal translation :

Broken, their head is convinced, their organs do not respond to him and their brain is partial.

#### Proposed translation :

Dysfunctioning, their head is convinced, their organs do not behave upon their will and their prefrontal cortexes do not care about the truth.

Scientific link :

**The truth about lying: inhibition of the anterior prefrontal cortex improves deceptive behavior, Ahmed A. Karim et al., 2010**

Recent neuroimaging studies have indicated a predominant role of the anterior prefrontal cortex (aPFC) in deception and moral cognition, yet the functional contribution of the aPFC to deceptive behavior remains unknown.

We hypothesized that modulating the excitability of the aPFC by transcranial direct current stimulation (tDCS) could reveal its functional contribution in generating deceitful responses. Forty-four healthy volunteers participated in a thief role-play in which they were supposed to steal money and then to attend an interrogation with the Guilty Knowledge Test. During the interrogation, participants received cathodal, anodal, or sham tDCS. Remarkably, inhibition of the aPFC by cathodal tDCS did not lead to an impairment of deceptive behavior but rather to a significant improvement. This effect manifested in faster reaction times in telling lies, but not in telling the truth, a decrease in sympathetic skin-conductance response and feelings of guilt while deceiving the interrogator and a significantly higher lying quotient reflecting skillful lying. Increasing the excitability of the aPFC by anodal tDCS did not affect deceptive behavior, confirming the specificity of the stimulation polarity. These findings give causal support to recent correlative data obtained by functional magnetic resonance imaging studies indicating a pivotal role of the aPFC in deception.

**Surah An-Nahl, Verse 78:**

كُمْتَشْكُرُونَ وَاللَّهَآخِرَ جَكْمَمْتَبُوتُونَ يَا مَهَاتِكُمْ لَا تَعْلَمُونَ شَيْئًا وَجَعَلْنَاكُمْ سَمْعًا أَبْصَارًا وَأَفْئِدَةً لَعَلَّكُمْ

Oua Allahou akhrajakoum min boutouni 'oumahatikoum la ta3lamouna chay'an oua ja3ala lakoumou alssam3a oual'absara oual'af'idata la3llakoum tachkouroun

- Al'af'idata coming from fu'ad is the targetted word
- Alssam3a coming from sam3a could mean : hearing
- Al'absara coming from basar could mean : sight

**Proposed literal translation :**

And God brought you out of the womb of your mothers without any knowledge and gave you the hearing the sight and the brain.

**Proposed translation :**

And God brought you out of your mothers' womb without any knowledge, and He gave you the hearing, the sight and the prefrontal cortex.

**Scientific link :**

**Convergence of Auditory, Visual, and Somatosensory Information in Ventral Prefrontal Cortex, Lizabeth M. Romanski, 2012**

«...Although a number of studies have examined the response of prefrontal neurons to face, vocalization, and somatosensory stimuli during passive fixation tasks, it is expected that the VLPFC utilizes these stimuli in more complex processes. There is no doubt that the context of a task will affect the firing of VLPFC neurons. Nonetheless, face and vocalization stimuli are different from typical simple sensory stimuli in that they already carry semantic meaning and emotional valence and need no additional task contexts to make them relevant. A face or vocalization, even when presented in a passive task, will be associated with previous experiences, emotions, and meanings that will evoke responses in a number of brain areas that project to the VLPFC, whereas simple sensory stimuli do not have innate associations and depend only on task contingencies to give them relevance. Thus, responses to face, voice, and other communication-relevant stimuli in prefrontal neurons are the sum total of experience with these stimuli in addition to any task or contextual information presented... »

**Surah Al-Isra, Verse 36:**

وَلَا تَقْفُوا مَا نِيسَلِكُمْ بِهِ لَعَلَّكُمْ تَعْلَمُونَ الْبَصَرَ وَالْفُؤَادَ لَعَلَّكُمْ تَعْلَمُونَ

Oua la taqfou ma laysa laka bihi 3ilmoun ina alssam3a oualbasara oualfu'adakouloun 'oula'ika kana 3anhou mas'oula

- Alfu'ada coming from fu'ad is the targetted word
- Taqfou coming from qaf could mean : to follow
- Mas'oula coming from mas'oul could mean : supervisor

**Proposed literal translation :**

And do not follow what you do not have any knowledge the hearing the sight and the brain all of them areitssupervisors

**Proposed translation :**

And don't follow what you do not have any knowledge about, the hearing, the sight and the prefrontal cortex are the supervisor of it.

**Scientific link :**

**Exploring the role of task performance and learning style on prefrontal hemodynamics during a working memory task**, Afrouz A. Anderson et al., 2018

Existing literature outlines the quality and location of activation in the prefrontal cortex (PFC) during working memory (WM) tasks. However, the effects of individual differences on the underlying neural process of WM tasks are still unclear. In this functional near infrared spectroscopy study, we administered a visual and auditory n-back task to examine activation in the PFC while considering the influences of task performance, and preferred learning strategy (VARK score). While controlling for age, results indicated that high performance (HP) subjects (accuracy > 90%) showed task dependent lower activation compared to normal performance subjects in PFC region. Specifically HP groups showed lower activation in left dorsolateral PFC (DLPFC) region during performance of auditory task whereas during visual task they showed lower activation in the right DLPFC. After accounting for learning style, we found a correlation between visual and aural VARK score and level of activation in the PFC. Subjects with higher visual VARK scores displayed lower activation during auditory task in left DLPFC, while those with higher visual scores exhibited higher activation during visual task in bilateral DLPFC. During performance of auditory task, HP subjects had higher visual VARK scores compared to NP subjects indicating an effect of learning style on the task performance and activation. The results of this study show that learning style and task performance can influence PFC activation, with applications toward neurological implications of learning style and populations with deficits in auditory or visual processing.

**Surah Al-Mumenoon, Verse 78:**

الْأَفِيذَةُ قَلِيلًا مَا تَشْكُرُونَ وَهُوَ الَّذِي أَنْشَأَكُمْ مِّنَ الْأَبْصَارِ وَ

**Oua houa alladhi ancha'a lakoumou alssam3a oual'absara oual'af'idata qalilan ma tachkouroun**

- Al'af'idata coming from fu'ad is the targeted word

**Proposed literal translation :**

And He is the One Who wants for you the hearing the sight and the brain only few of you are thankful

**Proposed translation :**

And He is the One Who wants for you the hearing, the sight and the prefrontal cortex, however only few among you are thankful.

**Scientific link :**

**Convergence of Auditory, Visual, and Somatosensory Information in Ventral Prefrontal Cortex**, Lizabeth M. Romanski, 2012

«...Although a number of studies have examined the response of prefrontal neurons to face, vocalization, and somatosensory stimuli during passive fixation tasks, it is expected that the VLPFC utilizes these stimuli in more complex processes. There is no doubt that the context of a task will affect the firing of VLPFC neurons. Nonetheless, face and vocalization stimuli are different from typical simple sensory stimuli in that they already carry semantic meaning and emotional valence and need no additional task contexts to make them relevant. A face or vocalization, even when presented in a passive task, will be associated with previous experiences, emotions, and meanings that will evoke responses in a number of brain areas that project to the VLPFC, whereas simple sensory stimuli do not have innate associations and depend only on task contingencies to give them relevance. Thus, responses to face, voice, and other communication-relevant stimuli in prefrontal neurons are the sum total of experience with these stimuli in addition to any task or contextual information presented... »

**Surah Al-Furqan, Verse 32:**

وَإِذْ كَذَّبْنَا بِكُلِّئْتِنَّبِيهِمْ فَوَادَّكَوْرَتْنَا هُنَّ رَبِّيَا وَقَالُوا لَآ إِلَهَ إِلَّا الَّذِي كَفَرُوا وَالْوَالِئَاتُ لَعَلِيْهَا أَقْرَابُ الْجَمَلَةِ

**Oua qala alladhina kafarou laou la nouzila 3layhi alqur'anou joumlatan oua7datan kadhalika liyouthabita bihi fou'adaka oua ratalnahou tartila**

- Fou'adaka coming from fu'ad is the targeted word
- Joumlatan coming from joumla could mean : totality
- Liyouthabita coming from thabata could mean : to consolidate
- Rtalnahou and tartila coming from tartil could mean : religious song

**Proposed literal translation :**

And those who disbelieve told if the Quran came down on him totally once it is like this that He consolidate with it your brain and We sang it in a perfect religious song.

**Proposed translation :**

And the disbelievers say « if the Quran came down in one time », however it is this way that He anchor your prefrontal cortex with it and We recitate it in a perfect way.

**Scientific link :**

**Prefrontal–hippocampal interaction during the encoding of new memories**, Kaori Takehara-Nishiuchi, 2020

The hippocampus rapidly forms associations among ongoing events as they unfold and later instructs the gradual stabilisation of their memory traces in the neocortex. Although this two-stage model of memory consolidation has gained substantial empirical support, parallel evidence from rodent studies suggests that the neocortex, in particular the medial prefrontal cortex, might work in concert with the hippocampus during the encoding of new experiences. This opinion article first summarises findings from behavioural, electrophysiological, and molecular studies in rodents that uncovered immediate changes in synaptic connectivity and neural selectivity in the medial prefrontal cortex during and shortly after novel experiences. Based on these findings, I then propose a model positing that the medial prefrontal cortex and hippocampus might use different strategies to encode information during novel experiences, leading to the parallel formation of complementary memory traces in the two regions. The hippocampus captures moment-to-moment changes in incoming inputs with accurate spatial and temporal contexts, whereas the medial prefrontal cortex may sort the inputs based on their similarity and integrates them over time. These processes of pattern recognition and integration enable the medial prefrontal cortex to, in real time, capture the central content of novel experience and emit relevancy signal that helps to enhance the contrast between the relevant and incidental features of the experience. This hypothesis serves as a framework for future investigations on the potential top-down modulation that the medial prefrontal cortex may exert over the hippocampus to enable the selective, perhaps more intelligent encoding of new information.

**Surah Al-Qasas, Verse 10:**

بَحْفُوا إِذَا مُمُوسَىٰ قَالَ عَائِلًا تَتَّبِعُنِي بِهَلْؤُ لَا أَنْزِ بَطْنًا عَلَّقَ بِهَا تَكُونُ مِنَّا مُمْمِنِينَ وَأَصْدُ

Oua 'asba7a fou'ada 'oumi Moussa farighan an kadat latoubdi bihi laoula in rabatna 3la qalbiha litakouna mina almou'minin

- Fou'ada coming from fou'ad is the targetted word
- Farighan coming from faragha could mean : to discharge
- Latoubdi coming from tabada could mean : to appear
- Rabatna coming from rabbit could mean : link

**Proposed literal translation :**

And the brain of the mother of Moussa began to discharge she almost appeared with him if We did not link with her heart so she is among the believers.

**Proposed translation :**

And the prefrontal cortex of Moussa's mother began to be inhibited that she almost discovered him, if We did not activate her heart in order to place her among the believers.

**Scientific link :**

**Reduced Right Ventrolateral Prefrontal Cortex Activity While Inhibiting Positive Affect is Associated with Improvement in Hedonic Capacity after 8 Weeks of Antidepressant Treatment in Major Depressive Disorder**, Sharee N. Light et al., 2011

Depressed individuals who could not inhibit positive emotion—evinced by reduced right ventrolateral prefrontal cortex (RVLPFC) activity during attempts to dampen their experience of positive emotion in response to positive visual stimuli—exhibited a steeper anhedonia reduction slope between baseline and 8 weeks of treatment with antidepressant medication ( $p < .05$ ). Controls showed a similar trend between baseline and Time 3.

**Surah As-Sajda, Verse 9:**

سَوَّاهُ وَنَفَخَ فِيهِ مِن رُّوحِهِ وَجَعَلَ لَكُمُ السَّمْعَ وَالْأَبْصَارَ وَالْأَفْئِدَةَ قَلِيلًا مَّا تَشْكُرُونَ ثُمَّ

Thouma saouahou ouanafakha fih min rou7ihi oua ja3ala lakoumou alsam3a oual'absara oual'af'idata qalilan ma tachkouroun

- Oual'af'idata coming from fu'ad is the targetted word
- Saouahou coming from saoua could mean : to compensate
- Nafakha coming from nafikha could mean : to infuse

**Proposed literal translation :**

Then He compensate him and infused a part of His soul and made him the hearing the sight and the brain only few of you are thankful

**Proposed translation :**

Then He compensate his wickness and He blew a part of His soul in him, and He gave him the hearing, the sight and the prefrontal cortex, however only few among you are thankful.

#### Scientific link :

**Human prefrontal cortex: evolution, development, and pathology**, Kate Teffer and Katerina Semendeferi, 2012

The prefrontal cortex is critical to many cognitive abilities that are considered particularly human, and forms a large part of a neural system crucial for normal socio-emotional and executive functioning in humans and other primates. In this chapter, we survey the literature regarding prefrontal development and pathology in humans as well as comparative studies of the region in humans and closely related primate species. The prefrontal cortex matures later in development than more caudal regions, and some of its neuronal subpopulations exhibit more complex dendritic arborizations. Comparative work suggests that the human prefrontal cortex differs from that of closely related primate species less in relative size than it does in organization. Specific reorganizational events in neural circuitry may have taken place either as a consequence of adjusting to increases in size or as adaptive responses to specific selection pressures. Living in complex environments has been recognized as a considerable factor in the evolution of primate cognition. Normal frontal lobe development and function are also compromised in several neurological and psychiatric disorders. A phylogenetically recent reorganization of frontal cortical circuitry may have been critical to the emergence of human-specific executive and social-emotional functions, and developmental pathology in these same systems underlies many psychiatric and neurological disorders, including autism and schizophrenia.

#### Surah Al-Ahqaf, Verse 26:

نَشِيَ إِذْ كَانُوا يَجْحَدُونَ بِآيَاتِ اللَّهِ وَحَاقَ بِهِم مَّا كَانُوا لَا أَبْصَارَ لَهُمْ وَلَا أَفْئِدَتُهُمْ مَّا وَقَدَّمْنَا لَهُمْ فِيمَا إِنَّمَا كُنَّا كُفِّيهِمْ وَجَعَلْنَا لَهُمْ سَمْعًا وَأَبْصَارًا وَأَفْئِدَةً فَمَا أَغْنَاهُمْ سَمْعُهُمْ  
وَابْهَيْتُهُمْ أَنْ يَرَوْنَ

**Oua laqad makanahoum fima in makanakoum fih ouaja3lna lahoum sam3an oua 'absaran oua 'af'idatan fama aghna 3anhoum sam3ouhoum oua la absarouhoum oua la 'af'idatouhoum min chay'in idh kanou yaj7adouna bi'ayati Allah oua haqa bihim ma kanou bihi yastahzi'oun**

- 'af'idatan and 'af'idatouhoum coming from fu'ad are the targetted words
- Makanahoum and makanakoum coming from makana could mean : to reinforce
- Aghna coming from 'aghana could mean : to enrich
- Yaj7adoun coming from ja7da could mean : to deny
- Yastahzi'oun coming from haza' could mean : to make fun

#### Proposed literal translation :

And We reinforced them while if We reinforce you in it and we gave them hearing and sight and brains but neither their hearing nor their sight nor their brains enriched them from nothing if they were denying God's verses and became true to them what they were making fun with.

#### Proposed translation :

And We reinforced them as We reinforce you, and we gave them the hearing, the sight and the prefrontal cortex, however neither the hearing, nor the sight, nor the prefrontal cortex has been useful when they were disbelieving in God's verses, and the thing they were making fun of it has truly arrived on them.

#### Scientific link :

**The neural underpinning of religious beliefs: Evidence from brain lesions**, Irene Cristofori et al., 2022

« ...Performing a confirmatory group analysis, the researchers found that the dlPFC lesion group reported experiencing increased mysticism. Notably, longitudinal analysis of pre-injury data (correlating with general intelligence and executive functions task performance) excludes explanations from individual differences. These findings support previous speculation linking executive functions to mystical experiences and reveal that executive functions (particularly those aspects of executive functions that depend upon dlPFC) causally contribute to the down-regulation of mystical experiences. This study provided evidence in favor of the executive inhibition hypothesis, for the emergence of mystical experiences. This hypothesis was based on previous studies where the authors observed decreased activity in the dlPFC during mystical exercises in practitioners of glossolalia [i.e., religious prayer group experiences in which individuals speak an incomprehensible language (Newberg et al., 2006)] or a reduction of cognitive resources invested in error monitoring during religious rituals (Schjoedt et al., 2013)... »



**Surah An-Najm, Verse 11:**

ذَبَّالْفُؤَادُ مَا رَأَى مَا كَا

**Ma kadhaba alfou'adou ma ra'a**

- Alfou'adou coming from fu'ad is the targetted word
- Kadhaba coming from kadhib could mean : something imagined
- Ra'a coming from ra'a could mean : clearly distinguish

**Proposed literal translation :**

The brain has not imagined what he clearly distinguished.

**Proposed translation :**

The prefrontal cortex has not generated by himself what he clearly saw.

**Scientific link :**

**On visual hallucinations and cortical networks: a trans-diagnostic review**, Rowena Carter and Dominic H. Ffytche, 2015

« ...Visual hallucinations were associated with reduced volume in bilateral occipital regions, right supramarginal gyrus and left fusiform gyrus, bilateral dorsolateral prefrontal cortex, frontal pole and the middle portion of the left cingulate gyrus... »

**Surah Al-Mulk, Verse 23:**

قُلْ هُوَ الَّذِي أَنْشَأَكُمْ وَجَعَلَ لَكُمُ السَّمْعَ وَالْأَبْصَارَ وَالْأَفْئِدَةَ قَلِيلًا مَّا تَشْكُرُونَ

**Qoul houa alladhi ancha'akoum oua ja3la lakoumou alsam3a oual'absara oual'af'idata qalilan ma tachkouroun**

- 'af'idata coming from fu'ad is the targetted word

**Proposed literal translation :**

Say He is the One Who wanted you and gave you the hearing the sight and the brain only few of you are thankful.

**Proposed translation :**

Say : « He is the One Who wanted you and gave you the hearing, the sight and the prefrontal cortex, however only few among you are thankful ».

**Scientific link :**

**Convergence of Auditory, Visual, and Somatosensory Information in Ventral Prefrontal Cortex**, Lizabeth M. Romanski, 2012

« ...Although a number of studies have examined the response of prefrontal neurons to face, vocalization, and somatosensory stimuli during passive fixation tasks, it is expected that the VLPFC utilizes these stimuli in more complex processes. There is no doubt that the context of a task will affect the firing of VLPFC neurons. Nonetheless, face and vocalization stimuli are different from typical simple sensory stimuli in that they already carry semantic meaning and emotional valence and need no additional task contexts to make them relevant. A face or vocalization, even when presented in a passive task, will be associated with previous experiences, emotions, and meanings that will evoke responses in a number of brain areas that project to the VLPFC, whereas simple sensory stimuli do not have innate associations and depend only on task contingencies to give them relevance. Thus, responses to face, voice, and other communication-relevant stimuli in prefrontal neurons are the sum total of experience with these stimuli in addition to any task or contextual information presented... »

**Surah Al-Humaza, Verse 5 to 9 :**

وَمَا أَدْرَاكُمَا الْحَطْمَةَ

نَارِ اللَّهِ الْمَوْقَدَةِ

الَّتِي تَطَّلِعُ عَلَى الْأَفْئِدَةِ

إِنَّهَا عَلَيْنَاهُمْ مَوْصَدَةٌ

فِي عَمَدٍ مُمَدَّدَةٍ

**Oua ma adraka mal7outama**

**Narou Allah almouqada**

**Allati tatali3ou 3ala al'af'ida**

**Innaha 3laihim mou'sada**

**Fi 3amadin moumadada**

- Al'af'ida coming from fu'ad is the targetted word
- Al7outama could come from 7atoum and could mean : digestive

- Narou coming from nar could mean : fire
- Almouqada coming from qada could mean : evaluated dimension
- Tatali3ou coming from tala3a could mean : to emerge
- Mou'sada coming from sada could mean : rust
- 3amadin coming from 3amad could mean :fixed
- Moumadada coming from mada could mean : flow

#### **Proposed literal translation :**

And who will tell you what is the gut punishment  
 The fire of God which has been dimensionned  
 That emerges on the brain  
 It is rust on them  
 In a fixed flows

#### **Proposed translation :**

And who will tell you what is the punishment from the gut,  
 The inflammation of God which has been well determined,  
 That raises until the prefrontal cortex,  
 It is oxydation of iron in them,  
 In a continous flow.

#### **Scientific link :**

#### **Regulation of prefrontal cortex myelination by the microbiota, A. E. Hoban et al., 2016**

The prefrontal cortex (PFC) is a key region implicated in a range of neuropsychiatric disorders such as depression, schizophrenia and autism. In parallel, the role of the gut microbiota in contributing to these disorders is emerging. Germ-free (GF) animals, microbiota-deficient throughout life, have been instrumental in elucidating the role of the microbiota in many aspects of physiology, especially the role of the microbiota in anxiety-related behaviours, impaired social cognition and stress responsivity. Here we aim to further elucidate the mechanisms of the microbial influence by investigating changes in the homeostatic regulation of neuronal transcription of GF mice within the PFC using a genome-wide transcriptome profiling approach. Our results reveal a marked, concerted upregulation of genes linked to myelination and myelin plasticity. This coincided with upregulation of neural activity-induced pathways, potentially driving myelin plasticity. Subsequent investigation at the ultrastructural level demonstrated the presence of hypermyelinated axons within the PFC of GF mice. Notably, these changes in myelin and activity-related gene expression could be reversed by colonization with a conventional microbiota following weaning. In summary, we believe we demonstrate for the first time that the microbiome is necessary for appropriate and dynamic regulation of myelin-related genes with clear implications for cortical myelination at an ultrastructural level. The microbiota is therefore a potential therapeutic target for psychiatric disorders involving dynamic myelination in the PFC.

#### **Inflammation, amygdala-ventromedial prefrontal functional connectivity and symptoms of anxiety and PTSD in African American women recruited from an inner-city hospital: Preliminary results, Neety D.**

Mehta et al., 2022

Inflammatory stimuli have been shown to impact brain regions involved in threat detection and emotional processing including amygdala and ventromedial prefrontal cortex (vmPFC), and to increase anxiety. Biomarkers of endogenous inflammation, including inflammatory cytokines and C-reactive protein (CRP), are reliably elevated in a subset of patients with depression and anxiety-related disorders such as post-traumatic stress disorder (PTSD), and have been associated with high anxiety in population studies. We previously reported that plasma CRP and cytokines in patients with depression were negatively correlated with resting-state functional connectivity (FC) between right amygdala and vmPFC, as assessed using both ROI to voxel-wise and targeted FC approaches, in association with symptoms of anxiety, particularly in patients with comorbid anxiety disorders or PTSD. To determine whether relationships between inflammation, right amygdala-vmPFC FC, and anxiety are reproducible across patient samples and research settings, we employed an a priori, hypothesis-driven approach to examine relationships between inflammation, targeted right amygdala-vmPFC FC and anxiety in a cohort of African American (AA) women (n = 54) recruited from an inner-city hospital population reliably found to have higher levels of inflammation (median CRP ~ 4 mg/L) as well as symptoms of anxiety, depression and PTSD. Higher concentrations of plasma CRP were associated with lower right amygdala-vmPFC FC ( $r = -0.32$ ,  $p = 0.017$ ), and this relationship remained significant when controlling for age, body mass index and number of lifetime trauma events experienced, as well as severity of PTSD and depression symptoms (all  $p < 0.05$ ). This

amygdala-vmPFC FC was similarly associated with a composite score of three inflammatory cytokines in a subset of women where plasma was available for analysis ( $n = 33$ ,  $r = -0.33$ ,  $p = 0.058$ ; adjusted  $r = -0.43$ ,  $p = 0.026$  when controlling for covariates including PTSD and depression symptom severity). Lower right amygdala-vmPFC FC was in turn associated with higher levels of anxiety reported to be generally experienced on the State-Trait Anxiety Inventory, trait component (adjusted  $r = -0.32$ ,  $p = 0.039$  when controlling for covariates). Exploratory analyses also revealed a negative correlation between severity of childhood maltreatment and right amygdala-vmPFC FC ( $r = -0.32$ ,  $p = 0.018$ ) that was independent of CRP and its association with FC, as well as an association between low amygdala-vmPFC FC and severity of PTSD symptoms, specifically the re-experiencing/intrusive symptom subscale (adjusted  $r = -0.32$ ,  $p = 0.028$  when controlling for covariates).

While CRP was not linearly associated with either anxiety or PTSD symptoms, CRP concentrations were higher in women reporting clinically significant anxiety or PTSD symptom severity when these symptoms were considered together (both  $p < 0.05$ ), but with no interaction. These results support our primary hypothesis that higher inflammation was associated with lower amygdala-vmPFC FC, a relationship that was detected using a hypothesis-driven, targeted approach. Findings also support that this phenotype of high CRP and low vmPFC FC was observed in association with anxiety in primary analyses, as well as symptoms of PTSD in exploratory analyses, in a cohort recruited from an inner-city population of AA women enriched for high inflammation, history of trauma exposure, and symptom severity. Larger, longitudinal samples are required to fully tease apart causal relationships between inflammatory biomarkers, FC and PTSD-related symptoms in future studies.

**Ceruloplasmin Deficiency Impaired Brain Iron Metabolism and Behavior in Mice**, Lijing Niu et al., 2022

Iron accumulation is an important cause of various brain diseases. As a ferroxidase, ceruloplasmin (Cp) plays a key role in iron homeostasis and its abnormal activity leads to iron accumulation. However, the detailed biological function of Cp in brain iron homeostasis needs to be investigated. In this study, Cp knockout mice were prepared and the changes in iron content and protein expression related to iron metabolism were detected. The results showed that iron accumulation occurred in multiple tissues and organs of Cp knockout mice, but there was no obvious change in brain tissues. However, Cp deficiency affected the expression of many iron metabolism-related proteins in midbrain, such as DMT1+IRE, heavy chain ferritin (H-ferritin) and light chain ferritin (L-ferritin). Cp deficiency also impaired the behavioral ability of mice, including weakened exercise ability and reduced motor coordination. In vitro cell experiment indicated that the sensitivity of Cp knockout neuron and astrocyte to hypoxia was higher than that of wild type, which means Cp deficiency leads to the damage of cell self-protection. All these results confirm that Cp exerts a protective effect on the brain by regulating iron metabolism.

**Increased regional brain concentrations of ceruloplasmin in neurodegenerative disorders**, D. A. Loeffler et al., 1996

Ceruloplasmin (CP), the major plasma anti-oxidant and copper transport protein, is synthesized in several tissues, including the brain. We compared regional brain concentrations of CP and copper between subjects with Alzheimer's disease (AD,  $n = 12$ ), Parkinson's disease (PD,  $n = 14$ ), Huntington's disease (HD,  $n = 11$ ), progressive supranuclear palsy (PSP,  $n = 11$ ), young adult normal controls (YC,  $n = 6$ ) and elderly normal controls (EC,  $n = 7$ ). Mean CP concentrations were significantly increased vs. EC ( $P < 0.05$ ) in AD hippocampus, entorhinal cortex, frontal cortex, and putamen. PD hippocampus, frontal, temporal, and parietal cortices, and HD hippocampus, parietal cortex, and substantia nigra. Immunocytochemical staining for CP in AD hippocampus revealed marked staining within neurons, astrocytes, and neuritic plaques. Increased CP concentrations in brain in these disorders may indicate a localized acute phase-type response and/or a compensatory increase to oxidative stress.

## Conclusion

All together, this methodology to understand the Quran seems to bring some proof through scientific literature. Indeed, we can easily find evidences that fu'ad could be the brain in the Quran, more specifically the prefrontal region of the brain. The surrounding words describing the word «fu'ad» are also aligned with this methodology. Thanks to these surrounding word we could find some precious informations about the brain and especially the prefrontal cortex.

To summarize, the prefrontal cortex in the Quran is tightly linked to hearing and sight as well as long-term memory formation and thus neuronal plasticity. Furthermore it has been demonstrated by the neuroscience that the prefrontal cortex is the supervisor of all the higher executive fonctions. Interestingly, the right dorsolateral prefrontal cortex seems to be involved in prayers and God 's relationship. That fact could easily be linked to the

words of the Quran that regularly mention the people of the right. Finally the fact that gut-brain axis could be tightly linked to a punishment from God when it induces an inflammation and can cause brain impairment such as neurodegeneration.

This methodology could be the key to study the scientific aspect of the Quran and advance in the world of scientific researches and medicines development. Briefly, the meaning of the words are really important to describe a certain context surrounding a scientific topic. We thus need to study the linguistic of the Quran to go for this method. Then we would need to experiment the found hypotheses and to validate or not the comprehension of the Quran's verses. If the understanding is good, the results will be positive, otherwise we would need to find another explanation to the meaning of a given verse of the Quran.