

Neuropsychological

Trends

39

April 2026

- Elisa De Bartolo - Giovanni Cicinelli - Stefania Brighenti
Emanuela Nobile - Francesca Capiotto - Roberto Keller*
A pilot investigation of the Italian short version of the Sensory
Perception Quotient (SPQ) in autistic and neurotypical adults 7
- Davide Crivelli - Michela Balconi*
Neuroassessment and monitoring of higher cognitive functions
in naturalistic context: a case of organizational neuroscience 23
- Rael H. Morley - Paul B. Jantz - Anastasia J. Gumatay
Bayley R. Grimshaw*
The impact of posterior cingulate and dorsal lateral connectivity
on aggression 43
- Michela Balconi - Laura Angioletti - Angelica Daffinà*
Are you sure about your choice? EEG correlates of decision
confidence before and after reframing 63
- Domenico Gambino*
Are negative affect and executive functioning related in healthy
young adults? 87
-

The impact of posterior cingulate and dorsal lateral connectivity on aggression

Rael H. Morley¹ - Paul B. Jantz² - Anastasia J. Gumatay¹ - Bayley R. Grimshaw¹

¹ School of Social Work, Texas State University, San Marcos, Texas, USA

² Counseling, Leadership, Adult Education and School Psychology, Texas State University, San Marcos, Texas, USA

DOI: <https://doi.org/10.7358/neur-2026-039-morl>

rm79@txstate.edu

ABSTRACT

This study investigates the impact of functional connectivity between the posterior cingulate (PCC), a key node of the default mode network of the brain, and the dorsal lateral prefrontal cortex (DLPFC), a key node of the central executive network in a sample of 48 unrelated male brains. Results indicate that weakened connectivity between the right PCC and the right DLPFC were linked to aggression. The implication of these findings is discussed in the context of current findings and future research.

Keywords: posterior cingulate; dorsal lateral prefrontal cortex; salience network; default mode network; aggression

1. INTRODUCTION

Throughout history, human aggression has shadowed human progress with untold suffering (Anderson & Huesman, 2003). Research in modern society has linked exposure to violence to neurological changes, increased hostile attributions, and the increased propensity to commit acts of aggression (see Morley et al., 2019 for a full review) with as many as 5.7 million victims during the year 2022 (Federal Bureau of Investigations, 2022). Incarcerating perpetrators of violence costs the U.S. Justice System \$182 billion annually (Wagner & Rabuy, 2017). Beyond these accumulating costs, victims of violence suffer socio-emotional costs (Langton & Truman, 2014). Given the impact of violence on our society, understanding the cause of violence is crucial for reducing recidivism, developing interventions, and predicting violent crime. Moreover, research suggests that many perpetrators of violence are male (U.S. Department of Justice – Federal Bureau of Investigation, 2025; Hodgins, 1994; Lurigio et al., 2020; Reaves, 2006). Moreover, data on arrests for violent crime (murder, nonnegligent manslaughter, rape, robbery, aggravated assault) in U.S. cities during 2019 indicate ~3.5 times as many males were arrested than females (U.S. Department of Justice – Federal Bureau of Investigation, 2025).

Although research suggests that by age 13 the default mode network (DMN) and central executive network CEN show about equal maturational trajectories (Sherman et al., 2014), Thijssen et al. (2015) noted significant DMN cortical thinning in aggressive children as early as age 6. It has been suggested that the potential impact of DMN abnormalities linked to exposure to violence and the principle of neuroplasticity may lead to developmental changes in the CEN (Morley, 2015). A key developmental pathway of interest in this regard could involve neurological connections between the posterior cingulate (PCC), a key node of the DMN, and the dorsolateral prefrontal cortex (DLPFC), a key node of the CEN (Achterberg et al., 2020; Buckley et al., 2014; Chai et al., 2014). Indeed, research has linked the DLPFC to perplexity emotional regulation (Buckley et al., 2014) and aggression (Achterberg et al., 2020) and Morley et al. (2023) also proposed that interactions between the PCC, a key node of the DMN, and the DLPFC, an important node of the CEN, may play an important role in aggression.

1.1 Large scale brain networks

The brain is a highly organized organ comprised of interactive dynamic systems, chemical processes, individual neurons, and complex regional and large-scale neuronal networks (Kandel et al., 2013). Large-scale brain networks integrate neuronal activity through hierarchical pathways to perform motor, psychological, perceptual, and cognitive functions (Bressler & Menon, 2010; van den Heuvel & Sporns, 2013).

Furthermore, these hierarchical brain systems include interconnected nodes and brain regions embedded within them (van den Heuvel & Sporns, 2011, 2013). Morley et al. (2019, 2023) have suggested three large-scale interconnected brain networks, the salience network (SN), CEN, and the DMN, may be linked to violent aggression.

1.2 Default mode network

The DMN consists of multiple brain regions including the ventral medial prefrontal cortex (VMPFC), PCC, precuneus, hippocampus, temporal parietal junction (TPJ), and dorsomedial prefrontal cortex (DMPFC) (Barrett & Satpute, 2013; Raichle, 2015). The DMN has been described as being internally focused and non-goal orientated and tending to increase activity at rest or during self-reflection (Buckner et al., 2008; Dosenbach et al., 2025; Greene et al., 2001; Gusnard et al., 2001; Harrison et al., 2008; Philippi & Koenig, 2014; Johnson et al., 2006; Raichle et al., 2001, 2015; Sebastian et al., 2008). The impaired activity in the DMN has been linked to multiple correlates of violence including exposure to violence, poverty, impulsivity, stress, and substance abuse (Dalwani et al., 2011; Sripada et al., 2012; Sripada et al., 2014; Sokołowski et al., 2022; Weissman et al., 2022).

Research also indicates that DMN is associated with violence (DiGangi et al., 2016; King et al., 2016) and reduced functional activation and connectivity in the DMN is associated with narcissistic aggression (Cale & Lilienfeld, 2006; Juárez et al., 2013; Sheng et al., 2010). Similarly, Pujol et al. (2012) found that psychopathic criminals have been shown to display less functional activity within key regions of the DMN (e.g., PCC, bilateral MPFC). Marin-Morales et al. (2022) found that violent criminals display less functional activation within the DMN compared to non-violent criminals. Finally, Motzkin et al. (2011) found less structural integrity within the uncinate fasciculus, a white matter tract connecting the VMPFC to the anterior temporal lobe, which includes connection to the amygdala.

1.3 Central executive network

The CEN consists of various regions of the brain including the DLPFC, the middle cingulate cortex, the limbic system, the cerebellum, the inferior parietal sulcus, and the temporal lobe (Bellebaum & Daum, 2007; D'Esposito, 2007; Fornito et al., 2011; Fuster, 2002; Laird et al., 2005; Ng et al., 2016; Niendam et al., 2012; Owen et al., 1990), is active during decision-making and is involved in impulse control (Elton et al., 2014; Rodrigo et al., 2014.). Research suggests aggressive and violent individuals display weak functional connectivity at rest (Contreras-Rodríguez et al., 2015; Thijssen &

Kiehl, 2017). Empirical studies also show violence and aggression prone individuals display less activity and grey matter in the CEN (Mehta & Beer, 2010; Raine et al., 2000; Wong et al., 2019). Finally, Achterberg et al.'s longitudinal study (2020) found strengthened functional activity in the DLPFC, a key node of the CEN, was linked to less aggression after experiencing social rejection.

1.4 The SN-DMN-CEN interaction

The SN intersects with the DMN and CEN (Menon & Uddin, 2010; Menon et al., 2023; Morley et al., 2019; Morley et al., 2023). The SN is characterized by many brain regions including the insular cortex and the anterior cingulate cortex (Barrett & Satpute, 2013; Menon & Uddin, 2010; Menon et al., 2023; Uddin, 2016). The SN is involved in detecting relevant internal and external information including threat detection as well as directing choice, processing tasks, regulating emotions, and arousal (Barrett & Satpute, 2013; Dosenbach et al., 2007; Ettinger et al., 2013; Philippi et al., 2015; Seeley et al., 2007; Yoder et al., 2015). Functional connectivity within the SN is anti-correlated with functional connectivity within the DMN and CEN (Barrett & Satpute, 2013; Seeley et al., 2007). Moreover, research suggests that the SN modulates the DMN and CEN (Barrett & Satpute, 2013; Seeley et al., 2007). Like the DMN and CEN, research has linked an overactive SN to violence and aggression (Aharoni et al., 2013; Cisler et al., 2013; Ettinger et al., 2013; Philippi et al., 2015; Sripada et al., 2012; Trzepacz et al., 2013; Yoder et al., 2015).

It has been suggested the intersection of SN, CEN, and DMN is associated with violence and aggression (Morley et al. 2019; Morley et al., 2023) and atrophy in brain regions associated with all three brain networks has been linked to violence among people diagnosed with dementia (Trzepacz et al., 2013). Research also suggests that developmentally, children prone to aggression display structural abnormalities within the DMN and SN earlier than abnormalities in the CEN; including the PCC, a key region of the DMN (Thijssen et al., 2015). Moreover, exposure to violence has been shown to disrupt connectivity between the SN and DMN (Cisler et al., 2013; Sripada et al., 2012).

A key developmental pathway of interest in this regard could involve a neurological connection between the PCC, a key node of the DMN, and the DLPFC, a key node of the CEN (Achterberg et al., 2020; Andrews-Hanna et al., 2007; Buckley et al., 2014; Chai et al., 2014). Evidence suggests that a correlation between the PCC and MPFC, key nodes of the DMN, and an anticorrelational functional connectivity between the MPFC, and the DLPFC, a key node of the CEN are linked to cognitive function (Andrews-Hanna et al., 2007; Chai et al., 2014).

Based on this evidence, Morley et al., (2023), hypothesized that abnormalities within the PCC, a key region of the DMN, stemming from a disruption in functional connectivity between the SN and the DMN caused by exposure to violence, could lead to neuroplastic changes in the CEN. Currently, researchers have not investigated the link between aggression and functional connectivity between the PCC, and DLPFC. To explore this topic, we examined functional connectivity between the DLPFC and PCC and self-reported physical aggression of 48 males within the 100 unrelated subjects of the Human Connectome Project (HCP).

2. METHOD

2.1 Participants

Participants in this investigation were collected from the HCP. The HCP is a big data initiative committed to exploring the neurological basis of behavior (Van Essen et al., 2013). The subjects for this study include the 48 male participants between the ages of 22 and 36 sampled from the 100 Unrelated HCP's minimally preprocessed pipeline which was released as part of 2017 data release of the 1200 healthy adults (Behavioral Unrestricted; Elam et al.,2021). Demographic data beyond gender and age were not available in the unrestricted data and are thus not reported. Participants from this project completed a battery of measurement tools including the NIH toolbox for assessing neurological and behavioral function (Toolbox Assessments, Inc, 2025).

2.2 Brain imaging data processing

All data were processed using version 3 of the HCP pipelines. A summary of the major processing steps for each pipeline and synoptic tables are available from the WU-Minn Consortium Human Connectome Project (Essen et al., 2013) with full descriptions found in Glasser et al. (2013).

Functional connectivity was measured by obtaining a correlation of bold signal between bilateral PCC: right (8, -56, 26) and left (-8, -56, 26) MNI coordinates; DLPFC: right (43, 21, 38) and left (-43, 21, 38) (Phillipi et al., 2015). The bold signals were extracted using the AFNI 3dUndump program. The resulting signal extractions included functional connectivity correlation coefficients corresponding to the rPCC/DLPFC and the lPCC/DLPFC (Morley, 2012).

2.3 Physical Aggression

Physical aggression was measured using the NIH Toolbox, Anger/Physical Aggression Survey Questionnaire (APASQ; Toolbox Assessments, Inc, 2025). This measure is an assessment of aggression as a behavioral component of anger for ages 18-85 using a 5-item fixed-length form. Each item administered has a 7-point scale with options ranging from “extremely untrue of me” to “extremely true of me”. The survey is scored using IRT methods.

An IRT-derived theta score is generated for each participant, as is an Uncorrected Standard Score (T-Score). For the NIH Toolbox APASQ, higher scores are indicative of more reported physical aggression. Scores 1 SD or more below the mean ($T \leq 40$) suggest low levels of physical aggression and scores 1 SD or more above the mean ($T \geq 60$) suggest high levels of physical aggression. T-scores ≥ 60 may warrant heightened surveillance or concern (Slotkin et al., 2012).

3. RESULTS

To explore the relationship between aggression and the functional connectivity of the bilateral PCC and DLPFC, descriptive statistics and correlational analysis were employed. The descriptive statistics and the correlation matrix are reported in Table 1. Correlational analysis reveals physical aggression is positively correlated with functional connectivity in the rPCC and rDLPFC $r = .264$; $p = .038$. However, analysis reveals that lPCC and lDLPFC are not associated with aggression (lPCC and lDLPFC $r = -0.10$, $p = .255$).

Table 1. Descriptive statistics and correlation matrix

	M	SD	Kurtosis	Skewness	Min	Max
APASQ	54.26	9.29	-0.8	0.399	43.4	77.2
IPCC-DLPFC	0.22	0.31	1.95	-1.19	-0.66	56
rPCC-DLPFC	0.56	0.28	1.14	-0.47	-0.76	0.87

	Physical Aggression	IPCC-DLPFC	rPCC-DLPFC
APASQ	1		
IPCC-DLPFC	0.26**	1	
rPCC-DLPFC	-0.07	-0.24**	1

Note. The IPCC-DLPFC and the rPCC-DLPFC variable represents the strength in functional connectivity strength between the left and right posterior cingulate and dorsal lateral prefrontal cortex. The APASQ represents the Anger/Physical Aggression Survey Questionnaire scores. This table presents descriptive statistics consisting of Men, N = 48. M and SD represent the Mean and Standard Deviation respectively. These include Pearson product moment correlation coefficients

* $p < .05$, ** $p < .01$

4. DISCUSSION

This study examines the relationship between physical aggression and anticorrelation in functional activity between the bilateral PCC, a key node of the DMN, and the DLPFC, a key node of the CEN. It finds a positive functional connectivity between key nodes is associated with physical aggression (as measured by the APASQ) in the right hemisphere.

These findings suggest physical aggression is associated with a weakened anticorrelation. That is, it appears to be associated with a reduced anticorrelation in signal between two key nodes of the CEN and DMN in the right hemisphere, but not the left. Previous research findings indicate that anticorrelation between key regions of the DMN and the DLPFC is associated with improved cognitive function and emotional wellbeing (Cao et al., 2016; Chai et al., 2014; King et al., 2016; Peters et al., 2016; Taylor et al., 2022).

Previous studies have also shown that a weakened resting state anticorrelation between the PCC and DLPFC has been associated with rumination and hyperarousal (King et al., 2016; Peters et al., 2016; Taylor et al., 2022). A recent meta-analysis of the role and function of the right DLPFC (Christian & Soutschek, 2022) suggests it is context-specific, playing an active part in implementing response inhibitions that override selfish interests when an individual is engaged in social decision making about others' fairness intention.

Research findings have also linked changes in activation of the DLPFC associated with childhood exposure to violence, to an increased propensity for violence in adulthood (Achterberg et al., 2020) and Thijssen et al. (2015). Also, found that structural differences in the posterior cingulate are associated with violence. Furthermore, Morley et al. (2023) also contend that exposure to violence leads to increased connectivity between the SN and the DMN, which leads to neuroplastic changes over time that weaken the anticorrelation between the CEN and DMN. This weakening could lead to diminished cognitive function, increased impulsivity, less self-awareness, and impaired emotional regulation, which in turn leads to an increased propensity for violence (Morley et al., 2023). Given that violence is a form of aggression (Allen & Anderson, 2017; National Collaborating Center for Mental Health, 2015; Morley et al., 2023), the current findings appear to support this hypothesis by demonstrating a diminished anticorrelation between the PCC and DLPFC are associated with aggression.

The findings from the current study contribute to an ongoing dialogue suggesting the large-scale brain network dynamics are associated with violence and antisocial behavior (See Morley et al., 2023). This dialogues include evidence suggesting that a disruption between the DMN and SN (Amaoui et al., 2022; Cisler et al., 2013; Sripada et al., 2012), connectivity within the DMN (Philippi et al., 2015), and connectivity between the CEN and the DMN and SN are all associated with proclivities towards violence (Achterberg et al., 2020; Romero-Martinez et al., 2019).

Another potential outcome to the current study relates to developing an intervention that could reduce the propensity of individuals to engage in aggression and violence. More specifically, understanding the underlying neurological mechanisms associated with violence and aggression could lead to interventions that lead to targeted changes that could reduce or eliminate violent behavior. One tool that shows great promise in this area is mindfulness-based interventions (MBI). Indeed, MBI have been shown to reduce violent behavior and criminal recidivism (Howell et al., 2010; Morley et al., 2021; Morley et al., 2024; Rainforth et al., 2003; Shonin et al., 2013). MBI has also been linked to functional changes in the CEN, DMN, and SN dynamics (Kilpatrick & Barsalou, 2012; Kilpatrick et al., 2011; Morley et al., 2023; Taylor et al., 2012). One outcome of this study could be to use the results to examine the impact of mindfulness functional connectivity changes between the PCC and DLPFC and aggression. Indeed, changes between these areas could suggest underlying neurosynaptic changes resulting in improved neurological efficacy and a reduced propensity to engage in violence.

4.1 Limitations

While one key premise of Morley et al.'s (2023) contention appears to be supported, to confirm this, future studies should reexamine these findings with a larger sample size and include key nodes of the SN to further explore the relationship between key nodes of these large-scale networks. For example, Morley et al. (2023) suggested that increased connectivity between the PCC and the insular cortex, a key node of the SN, should mirror the diminished connectivity between key nodes of the DMN and connectivity between the PCC and the DLPFC. Future studies could examine these interconnections more thoroughly to further explore Morley et al.'s 2023 contentions.

While this study does suggest some interesting information concerning the relationship between large-scale networks and physical aggression. There are key areas of concern that should be stated. One of these is that the tool for aggression is a self-report measure. Research indicates that self-reporting is sensitive to bias and falsification (Howard & Daily, 1979; Podsakoff et al., 2003). While there is no evidence to suggest that these subjects fabricated these results, the potential for such occurrences does exist and can't be ruled out. Further, the APASQ is a screener of aggression as a behavioral component of anger and although higher scores are indicative of more reported physical aggression, it may not represent actual physical aggression. Finally, additional work remains to examine the predictive and concurrent validity of these measures and to identify clinically meaningful thresholds (Slotkin et al., 2012).

Another key limitation is that this study examined key nodes of large-scale networks rather than looking at the large-scale networks holistically. This limitation could underestimate the impact of dynamics between other regions and interconnection within and between large-scale networks. Finally, this study only examined a male sample. Future studies should include a comparative age-matched female sample.

5. CONCLUSION

The findings of this study indicate functional connectivity between the right PCC, a key node of the DMN, and the right DLPFC, a key node of the CEN, are associated with self-reported physical aggression. These findings appear to support Morley et al.'s 2023 contention that a weak anticorrelation between the PCC and DLPFC is linked to physical aggression.

Acknowledgements

Data were provided [in part] by the Human Connectome Project, WU-Minn Consortium (Principal Investigators: David Van Essen and Kamil Ugurbil; 1U54MH091657) funded by the 16 NIH Institutes and Centers that support the NIH Blueprint for Neuroscience Research; and by the McDonnell Center for Systems Neuroscience at Washington University.

REFERENCES

- Achterberg, M., van Duijvenvoorde, A. C. K., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Crone, E. A. (2020). Longitudinal changes in DLPFC activation during childhood are related to decreased aggression following social rejection. *Proceedings of the National Academy of Sciences of the United States of America*, 117(15), 8602–8610. <https://doi.org/10.1073/pnas.1915124117>
- Aharoni, E., Vincent, G. M., Harenski, C. L., Calhoun, V. D., Sinnott-Armstrong, W., Gazzaniga, M. S., & Kiehl, K. A. (2013). Neuroprediction of future rearrest. *Proceedings of the National Academy of Sciences of the United States of America*, 110(15), 6223–6228. <https://doi.org/10.1073/pnas.1219302110>
- Allen, J. J., & Anderson, C. A. (2017). Aggression and violence: Definitions and distinctions, In P. Sturmey, *The Wiley Handbook of Violence and Aggression*, (pp. 1-14). John Wiley & Sons. https://doi.org/10.1007/978-3-031-04386-4_1
- Amaoui, S., Martín-Pérez, C., Marín-Morales, A., Bueso-Izquierdo, N., García-León, M. Á., Pérez-García, M., & Verdejo-Román, J. (2022). Resting-state functional connectivity and socioemotional processes in male perpetrators of intimate partner violence against women. *Scientific Reports*, 12(1), 1-11. <https://www.nature.com/articles/s41598-022-14181-2>
- Anderson, C.A. & Huesmann, L.R. (2003). Human aggression: A social-cognitive view. In: Hogg, M.A. and Cooper, J., (Eds.), *The Sage handbook of social psychology*, (pp. 296-323) Sage Publications Ltd. <https://doi.org/10.4135/9781848608221.n12>.
- Andrews-Hanna, J. R., Snyder, A. Z., Vincent, J. L., Lustig, C., Head, D., Raichle, M. E., & Buckner, R. L. (2007). Disruption of large-scale brain systems in advanced aging. *Neuron*, 56(5), 924–935. <https://doi.org/10.1016/j.neuron.2007.10.038>
- Barrett, L. F., & Satpute, A. B. (2013). Large-scale brain networks in affective and social neuroscience: towards an integrative functional architecture

- of the brain. *Current Opinion in Neurobiology*, 23(3), 361–372. <https://doi.org/10.1016/j.conb.2012.12.012>
- Bellebaum, C., & Daum, I. (2007). Cerebellar involvement in executive control. *Cerebellum*, 6(3), 184–192. <https://doi.org/10.1080/14734220601169707>
- Bressler, S. L., & Menon, V. (2010). Large-scale brain networks in cognition: Emerging methods and principles. *Trends in Cognitive Sciences*, 14(6), 277–290. <https://doi.org/10.1016/j.tics.2010.04.004>
- Buckley, M., & Saarni, C. (2014). Emotion regulation: Implications for positive youth development. In M. J. Furlong, R. Gilman, & E. S. Huebner (Eds.), *Handbook of positive psychology in schools., 2nd ed.* (pp. 99–114). Routledge/Taylor & Francis Group.
- Buckley, J., Cohen, J. D., Kramer, A. F., McAuley, E., & Mullen, S. P. (2014). Cognitive control in the self-regulation of physical activity and sedentary behavior. *Frontiers in Human Neuroscience*, 8, 747. <https://doi.org/10.3389/fnhum.2014.00747>
- Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network: anatomy, function, and relevance to disease. *Annals of the New York Academy of Sciences*, 1124, 1–38. <https://doi.org/10.1196/annals.1440.011>
- Cale, E. M., & Lilienfeld, S. O. (2006). Psychopathy factors and risk for aggressive behavior: A test of the "threatened egotism" hypothesis. *Law and Human Behavior*, 30(1), 51–74. <https://doi.org/10.1007/s10979-006-9004-5>
- Cao, W., Cao, X., Hou, C., Li, T., Cheng, Y., Jiang, L., Luo, C., Li, C., & Yao, D. (2016). Effects of Cognitive Training on Resting-State Functional Connectivity of Default Mode, Salience, and Central Executive Networks. *Frontiers in aging neuroscience*, 8, 70. <https://doi.org/10.3389/fnagi.2016.00070>
- Chai, X. J., Ofen, N., Gabrieli, J. D. E., & Whitfield-Gabrieli, S. (2014). Development of deactivation of the default-mode network during episodic memory formation. *NeuroImage*, 84, 932–938. <https://doi.org/10.1016/j.neuroimage.2013.09.032>
- Christian, P., & Soutschek, A. (2022). Causal role of right dorsolateral prefrontal cortex for norm-guided social decision making: A meta-analysis of TMS studies. *Neuropsychologia*, 176. <https://doi.org/10.1016/j.neuropsychologia.2022.108393>
- Cisler, J. M., Steele, J. S., Smitherman, S., Lenow, J. K., & Kilts, C. D. (2013). Neural processing correlates of assaultive violence exposure and PTSD symptoms during implicit threat processing: A network-level analysis among adolescent girls. *Psychiatry Research: Neuroimaging*, 214(3), 238–246. <https://doi.org/10.1016/j.psychresns.2013.06.003>
- Contreras-Rodríguez, O., Pujol, J., Batalla, I., Harrison, B. J., Soriano-Mas, C., Deus, J., López-Solà, M., Macià, D., Pera, V., Hernández-Ribas, R., Pifarré, J., Menchón, J. M., & Cardoner, N. (2015). Functional connectivity bias in

- the prefrontal cortex of psychopaths. *Biological psychiatry*, 78(9), 647–655. <https://doi.org/10.1016/j.biopsych.2014.03.007>
- Dalwani, M., Sakai, J. T., Mikulich-Gilbertson, S. K., Tanabe, J., Raymond, K., McWilliams, S. K., Thompson, L. L., Banich, M. T., & Crowley, T. J. (2011). Reduced cortical gray matter volume in male adolescents with substance and conduct problems. *Drug and Alcohol Dependence*, 118(2-3), 295–305. <https://doi.org/10.1016/j.drugalcdep.2011.04.006>
- D'Esposito M. (2007). From cognitive to neural models of working memory. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, 362(1481), 761–772. <https://doi.org/10.1098/rstb.2007.2086>
- DiGangi, J. A., Tadayyon, A., Fitzgerald, D. A., Rabinak, C. A., Kennedy, A., Klumpp, H., Rauch, S. A., & Phan, K. L. (2016). Reduced default mode network connectivity following combat trauma. *Neuroscience letters*, 615, 37–43. <https://doi.org/10.1016/j.neulet.2016.01.010>
- Dosenbach, N. U. F., Fair, D. A., Miezin, F. M., Cohen, A. L., Wenger, K. K., Dosenbach, R. A., Fox, M. D., Snyder, A. Z., Vincent, J. L., Raichle, M. E., Schlaggar, B. L., & Petersen, S. E. (2007). Distinct brain networks for adaptive and stable task control in humans. *Proceedings of the National Academy of Sciences of the United States of America*, 104(26), 11073–11078. <https://doi.org/10.1073/pnas.0704320104>
- Dosenbach, N. U. F., Raichle, M. E., & Gordon, E. M. (2025). The brain's action-mode network. *Nature Reviews Neuroscience*, 26(3), 158–168. <https://doi.org/10.1038/s41583-024-00895-x>
- Elam, J. S., Glasser, M. F., Harms, M. P., Sotiropoulos, S. N., Andersson, J. L. R., Burgess, G. C., Curtiss, S. W., Oostenveld, R., Larson-Prior, L. J., Schoffelen, J. M., Hodge, M. R., Cler, E. A., Marcus, D. M., Barch, D. M., Yacoub, E., Smith, S. M., Ugurbil, K., & Van Essen, D. C. (2021). The Human Connectome Project: A retrospective. *NeuroImage*, 244, 118543. <https://doi.org/10.1016/j.neuroimage.2021.118543>
- Elton, A., & Gao, W. (2014). Divergent task-dependent functional connectivity of executive control and salience networks. *Cortex*, 51, 56–66. <https://doi.org/10.1016/j.cortex.2013.10.012>
- Ettinger, U., Corr, P. J., Mofidi, A., Williams, S. C., & Kumari, V. (2013). Dopaminergic basis of the psychosis-prone personality investigated with functional magnetic resonance imaging of procedural learning. *Frontiers in Human Neuroscience*, 7, 1–11. <https://doi.org/10.3389/fnhum.2013.00130>

- Federal Bureau of Investigation. (2022). *Uniform crime reporting program: National Incident-Based Reporting System* (NIBRS). <https://www.fbi.gov/how-we-can-help-you/more-fbi-services-and-information/ucr/nibrs>
- Fornito, A., Yoon, J., Zalesky, A., Bullmore, E. T., & Carter, C. S. (2011). General and specific functional connectivity disturbances in first-episode schizophrenia during cognitive control performance. *Biological Psychiatry*, *70*(1), 64–72. <https://doi.org/10.1016/j.biopsych.2011.02.019>
- Fuster J. M. (2002). Frontal lobe and cognitive development. *Journal of neurocytology*, *31*(3-5), 373–385. <https://doi.org/10.1023/a:1024190429920>
- Glasser, M. F., Sotiropoulos, S. N., Wilson, J. A., Coalson, T. S., Fischl, B., Andersson, J. L., Xu, J., Jbabdi, S., Webster, M., Polimeni, J. R., Van Essen, D. C., Jenkinson, M., & WU-Minn HCP Consortium (2013). The minimal preprocessing pipelines for the Human Connectome Project. *NeuroImage*, *80*, 105–124. <https://doi.org/10.1016/j.neuroimage.2013.04.127>
- Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., & Cohen, J. D. (2001). An fMRI investigation of emotional engagement in moral judgment. *Science*, *293*(5537), 2105–2108. <https://doi.org/10.1126/science.1062872>
- Gusnard, D. A., Akbudak, E., Shulman, G. L., & Raichle, M. E. (2001). Medial prefrontal cortex and self-referential mental activity: relation to a default mode of brain function. *Proceedings of the National Academy of Sciences of the United States of America*, *98*(7), 4259–4264. <https://doi.org/10.1073/pnas.071043098>
- Harrison, B. J., Pujol, J., Ortiz, H., Fornito, A., Pantelis, C., & Yücel, M. (2008). Modulation of brain resting-state networks by sad mood induction. *PLoS one*, *3*(3), e1794. <https://doi.org/10.1371/journal.pone.0001794>
- Hasenkamp, W., & Barsalou, L. W. (2012). Effects of meditation experience on functional connectivity of distributed brain networks. *Frontiers in Human Neuroscience*, *6*(38), 1–14. <https://doi.org/10.3389/fnhum.2012.00038>
- Hodgins, S. (1994). Status at age 30 of children with conduct problems. *Studies of Crime and Crime Prevention*, *3*, 41–62. <https://www.ojp.gov/ncjrs/virtual-library/abstracts/status-age-30-children-conduct-problems>
- Howard, G. S., & Dailey, P. R. (1979). Response-shift bias: A source of contamination of self-report measures. *Journal of Applied Psychology*, *64*(2), 144–150. <https://doi.org/10.1037/0021-9010.64.2.144>
- Howells, K., Tennant, A., Day, A., & Elmer, R. (2010). Mindfulness in forensic mental health: Does it have a role? *Mindfulness*, *1*(1), 4–9. <https://doi.org/10.1007/s12671-009-0001-x>

- Johnson, S. C., Schmitz, T. W., Moritz, C. H., Meyerand, M. E., Rowley, H. A., Alexander, A. L., Hansen, K. W., Gleason, C. E., Carlsson, C. M., Ries, M. L., Asthana, S., Chen, K., Reiman, E. M., & Alexander, G. E. (2006). Activation of brain regions vulnerable to Alzheimer's disease: the effect of mild cognitive impairment. *Neurobiology of Aging*, 27(11), 1604–1612. <https://doi.org/10.1016/j.neurobiolaging.2005.09.017>
- Juárez, M., Kiehl, K. A., & Calhoun, V. D. (2013). Intrinsic limbic and paralimbic networks are associated with criminal psychopathy. *Human Brain Mapping*, 34(8), 1921–1930. <https://doi.org/10.1002/hbm.22037>
- Kandel, E. R., Markram, H., Matthews, P. M., Yuste, R., & Koch, C. (2013). Neuroscience thinks big (and collaboratively). *Nature Reviews Neuroscience*, 14(9), 659–664. <https://doi.org/10.1038/nrn3578>
- Kilpatrick, L. A., Suyenobu, B. Y., Smith, S. R., Bueller, J. A., Goodman, T., Creswell, J. D., Tillisch, K., Mayer, E. A., & Naliboff, B. D. (2011). Impact of Mindfulness-Based Stress Reduction training on intrinsic brain connectivity. *NeuroImage*, 56(1), 290–298. <https://doi.org/10.1016/j.neuroimage.2011.02.034>
- King, A. P., Block, S. R., Sripada, R. K., Rauch, S. A., Porter, K. E., Favorite, T. K., & Liberzon, I. (2016). A pilot study of mindfulness-based exposure therapy in OEF/OIF combat veterans with PTSD: Altered medial frontal cortex and amygdala responses in social-emotional processing. *Frontiers in Psychiatry*, 7(154), <https://doi.org/10.3389/fpsy.2016.00154>.
- Laird, A. R., McMillan, K. M., Lancaster, J. L., Kochunov, P., Turkeltaub, P. E., Pardo, J. V., & Fox, P. T. (2005). A comparison of label-based review and ALE meta-analysis in the Stroop task. *Human brain mapping*, 25(1), 6–21. <https://doi.org/10.1002/hbm.20129>
- Langton, L., & Truman, J. L. (2014). *Socio-emotional impact of violent crime*. U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. <https://bjs.ojp.gov/content/pub/pdf/sivc.pdf>
- Lurigio, A. J., & Staton, M. D. (2020). The measurement and prevalence of violent crime in the United States: persons, places, and times. *Journal of Crime and Justice*, 43(3), 282–306. <https://www.tandfonline.com/doi/full/10.1080/0735648X.2019.1656102>
- Marín-Morales, A., Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Pérez-García, M., Catena-Martínez, A., & Verdejo-Román, J. (2022). “Would you allow your wife to dress in a miniskirt to the party?” Batterers do not activate default mode network during moral decisions about intimate partner violence. *Journal of Interpersonal Violence*, 37(3–4), 1463–1488. <https://doi.org/10.1177/0886260520926494>

- Mehta, P. H., & Beer, J. (2010). Neural mechanisms of the testosterone-aggression relation: the role of orbitofrontal cortex. *Journal of cognitive neuroscience*, 22(10), 2357–2368. <https://doi.org/10.1162/jocn.2009.21389>
- Menon, V., & Uddin, L. Q. (2010). Saliency, switching, attention and control: A network model of insula function. *Brain structure & function*, 214(5-6), 655–667. <https://doi.org/10.1007/s00429-010-0262-0>
- Menon, V., Cerri, D., Lee, B., Yuan, R., Lee, S. H., & Shih, Y. I. (2023). Optogenetic stimulation of anterior insular cortex neurons in male rats reveals causal mechanisms underlying suppression of the default mode network by the salience network. *Nature Communications*, 14(1), 866. <https://doi.org/10.1038/s41467-023-36616-8>
- Morley, R. H. (2012). *Cerebello-striatal connectivity and implicit learning in autism spectrum disorders* (Doctoral dissertation, University of Texas). <https://repositories.lib.utexas.edu/bitstreams/e2d6a27d-c57c-4062-a072-6fdc213dd88b/download>
- Morley, R. H. (2015). Violent criminality and self-compassion. *Aggression and Violent Behavior*, 24, 226–240. <https://doi.org/10.1016/j.avb.2015.05.017>
- Morley, R. H., Jantz, P. B., & Fulton, C. (2019). The intersection of violence, brain networks, and mindfulness practices. *Aggression and Violent Behavior*, 46, 165–173. <https://doi.org/10.1016/j.avb.2019.02.007>
- Morley, R. H., Bowman, S. W., Fulton, C. L., Roche, S. P., Jantz, P. B., & Trujillo, L. T. (2021). Mindfulness, self-control, implicit bias, race, threat perception failure, and the accidental use of deadly force against off-duty police officers. *Journal of police and criminal psychology*, 36(1), 86–95.
- Morley, R. H., Jantz, P. B., Fulton, C. L., & Trujillo, L. T. (2023). Objective self-awareness theory and violence: A brain network perspective. *Neuroscience and Behavioral Physiology*, 53(4), 636–653. <https://doi.org/10.1007/s11055-023-01421-9>
- Morley, R. H., Fulton, C. L., Bowman, S. W., & Trujillo, L. T. (2024). Exploring the intersection of mindfulness, race-related threat perception failure, and the use of deadly f. *Journal of Police and Criminal Psychology*, 39(1), 64–74. <https://doi.org/10.1007/s11896-023-09612-3>
- Motzkin, J. C., Newman, J. P., Kiehl, K. A., & Koenigs, M. (2011). Reduced prefrontal connectivity in psychopathy. *The Journal of neuroscience: the official journal of the Society for Neuroscience*, 31(48), 17348–17357. <https://doi.org/10.1523/jneurosci.4215-11.2011>
- National Collaborating Centre for Mental Health. (2015). *Violence and aggression: Short-term management in mental health, health and community settings*

- (NICE Guideline No. 10). British Psychological Society. <https://www.ncbi.nlm.nih.gov/books/NBK356335/>
- Ng, K. K., Lo, J. C., Lim, J. K. W., Chee, M. W. L., & Zhou, J. (2016). Reduced functional segregation between the default mode network and the executive control network in healthy older adults: A longitudinal study. *NeuroImage*, 133, 321–330. <https://doi.org/10.1016/j.neuroimage.2016.03.029>
- Niendam, T. A., Laird, A. R., Ray, K. L., Dean, Y. M., Glahn, D. C., & Carter, C. S. (2012). Meta-analytic evidence for a superordinate cognitive control network subserving diverse executive functions. *Cognitive, Affective & Behavioral Neuroscience (Print)*, 12(2), 241–268. doi: 10.3758/s13415-011-0083-5.
- Owen, A. M., Downes, J. J., Sahakian, B. J., Polkey, C. E., & Robbins, T. W. (1990). Planning and spatial working memory following frontal lobe lesions in man. *Neuropsychologia*, 28(10), 1021–1034. [https://doi.org/10.1016/0028-3932\(90\)90137-d](https://doi.org/10.1016/0028-3932(90)90137-d)
- Peters, A. T., Burkhouse, K., Feldhaus, C. C., Langenecker, S. A., & Jacobs, R. H. (2016). Aberrant resting-state functional connectivity in limbic and cognitive control networks relates to depressive rumination and mindfulness: A pilot study among adolescents with a history of depression. *Journal of Affective Disorders*, 200, 178–181. <https://www.sciencedirect.com/science/article/pii/S0165032715312295>
- Philippi, C. L., & Koenigs, M. (2014). The neuropsychology of self-reflection in psychiatric illness. *Journal of Psychiatric Research*, 54, 55–63. doi:10.1016/j.jpsychires.2014.03.004
- Philippi, C. L., Pujara, M. S., Motzkin, J. C., Newman, J., Kiehl, K. A., & Koenigs, M. (2015). Altered resting-state functional connectivity in cortical networks in psychopathy. *Journal of Neuroscience*, 35(15), 6068–6078. <https://doi.org/10.1523/jneurosci.5010-14.2015>
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *The Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Pujol, J., Batalla, I., Contreras-Rodríguez, O., Harrison, B. J., Pera, V., Hernández-Ribas, R., Real, E., Bosa, L., Soriano-Mas, C., Deus, J., López-Solà, M., Pifarré, J., Menchón, J. M., & Cardoner, N. (2012). Breakdown in the brain network subserving moral judgment in criminal psychopathy. *Social Cognitive and Affective Neuroscience*, 7(8), 917–923. <https://doi.org/10.1093/scan/nsr075>
- Raichle, M. E., MacLeod, A. M., Snyder, A. Z., Powers, W. J., Gusnard, D. A., & Shulman, G. L. (2001). A default mode of brain function. *Proceedings of the*

- National Academy of Sciences of the United States of America*, 98(2), 676–682. <https://doi.org/10.1073/pnas.98.2.676>
- Raichle M. E. (2015). The brain's default mode network. *Annual Review of Neuroscience*, 38, 433–447. <https://doi.org/10.1146/annurev-neuro-071013-014030>
- Rainforth, M. V., Alexander, C. N., & Cavanaugh, K. L. (2003). Effects of the transcendental meditation program on recidivism among former inmates of Folsom prison: Survival analysis of 15-year follow-up data. *Journal of Offender Rehabilitation*, 36(1–4), 181–203. https://doi.org/10.1300/J076v36n01_09.
- Raine, A., Lencz, T., Bihrlé, S., LaCasse, L., & Colletti, P. (2000). Reduced prefrontal gray matter volume and reduced autonomic activity in antisocial personality disorder. *Archives of General Psychiatry*, 57(2), 119–127. <https://doi.org/10.1001/archpsyc.57.2.119>
- Reaves, B. A. (2006). *Violent felons in large urban counties*. U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. <https://bjs.ojp.gov/library/publications/violent-felons-large-urban-counties>
- Rodrigo, M. J., Padrón, I., de Vega, M., & Ferstl, E. C. (2014). Adolescents' risky decision-making activates neural networks related to social cognition and cognitive control processes. *Frontiers in human neuroscience*, 8, 60. <https://doi.org/10.3389/fnhum.2014.00060>
- Romero-Martínez, Á., González, M., Lila, M., Gracia, E., Martí-Bonmatí, L., Alberich-Bayarri, Á., ... & Moya-Albiol, L. (2019). The brain resting-state functional connectivity underlying violence proneness: is it a reliable marker for neurocriminology? A systematic review. *Behavioral Sciences*, 9(1), 11. <https://doi.org/10.3390/bs9010011>
- Sebastian, C., Burnett, S., & Blakemore, S. J. (2008). Development of the self-concept during adolescence. *Trends in Cognitive Sciences*, 12(11), 441–446. <https://doi.org/10.1016/j.tics.2008.07.008>
- Seeley, W. W., Menon, V., Schatzberg, A. F., Keller, J., Glover, G. H., Kenna, H., Reiss, A. L., & Greicius, M. D. (2007). Dissociable intrinsic connectivity networks for salience processing and executive control. *The Journal of Neuroscience*, 27(9), 2349–2356. <https://doi.org/10.1523/JNEUROSCI.5587-06.2007>
- Sheng, T., Gheyntanchi, A., & Aziz-Zadeh, L. (2010). Default network deactivations are correlated with psychopathic personality traits. *PLoS ONE*, 5(9), 1–7. <https://doi.org/10.1371/journal.pone.0012611>
- Sherman, L. E. Rudie, J. D., Pfeifer, J. H., Msten, C. L., McNealy, K., & Dapretto, M. (2014). Networks a cross early adolescence: A longitudinal study. *Developmental Cognitive Neuroscience*, 10, 148–159. <http://www.elsevier.com/locate/dcn>

- Shonin, E., Van Gordon, W., Slade, K., & Griffiths, M. D. (2013). Mindfulness and other Buddhist-derived interventions in correctional settings: A systematic review. *Aggression and Violent Behavior, 18*(3), 365–372. <https://doi.org/10.1016/j.avb.2013.01.002>
- Slotkin, J., Nowinski, C., Hays, R., Beaumont, J., Griffith, J., Magasi, S., Salsman, J., & Gershon, R. (2012). *NIH toolbox scoring and interpretation guide*, National Institutes of Health and Northwestern University. <https://nihtoolbox.zendesk.com/hc/en-us/categories/10185664963604-NIH-Toolbox-V2>
- Sokołowski, A., Kowalski, J., & Dragan, M. (2022). Neural functional connectivity during rumination in individuals with adverse childhood experiences. *European Journal of Psychotraumatology, 13*(2000-8066), 2057700. <https://doi.org/doi:10.1080/20008198.2022.2057700>
- Sripada, R. K., King, A. P., Garfinkel, S. N., Wang, X., Sripada, C. S., Welsh, R. C., & Liberzon, I. (2012). Altered resting-state amygdala functional connectivity in men with posttraumatic stress disorder. *Journal of Psychiatry & Neuroscience, 37*(4), 241–249. <https://doi.org/10.1503/jpn.110069>
- Sripada, C., Kessler, D., Fang, Y., Welsh, R. C., Prem Kumar, K., & Angstadt, M. (2014). Disrupted network architecture of the resting brain in attention-deficit/hyperactivity disorder. *Human Brain Mapping, 35*(9), 4693–4705. <https://doi.org/10.1002/hbm.22504>
- Taylor, J. E., Yamada, T., Kawashima, T., Kobayashi, Y., Yoshihara, Y., Miyata, J., ... & Motegi, T. (2022). Depressive symptoms reduce when dorsolateral prefrontal cortex-precuneus connectivity normalizes after functional connectivity neurofeedback. *Scientific reports, 12*(1), 1-19. <https://www.nature.com/articles/s41598-022-05860-1>
- Thijssen, S., Ringoot, A. P., Wildeboer, A., Bakermans-Kranenburg, M. J., El Marroun, H., Hofman, A., Jaddoe, V. W., Verhulst, F. C., Tiemeier, H., van IJzendoorn, M. H., & White, T. (2015). Brain morphology of childhood aggressive behavior: A multi-informant study in school-age children. *Cognitive, affective & behavioral neuroscience, 15*(3), 564–577. <https://doi.org/10.3758/s13415-015-0344-9>
- Thijssen, S., & Kiehl, K. A. (2017). Functional connectivity in incarcerated male adolescents with psychopathic traits. *Psychiatry research. Neuroimaging, 265*, 35–44. <https://doi.org/10.1016/j.psychresns.2017.05.005>
- Toolbox Assessments, Inc (2025). The NIH Toolbox® - *Emotion*. <https://nihtoolbox.org/domain/emotion/>
- Trzepacz, P. T., Yu, P., Bhamidipati, P. K., Willis, B., Forrester, T., Tabas, L., ... & Alzheimer's Disease Neuroimaging Initiative. (2013). Frontolimbic atrophy is

- associated with agitation and aggression in mild cognitive impairment and Alzheimer's disease. *Alzheimer's & Dementia*, 9(5), S95-S104. <https://doi.org/10.1016/j.jalz.2012.10.005>
- Uddin, L. Q. (2016). *Salience network of the human brain*. Academic press.
- U.S. Department of Justice, Federal Bureau of Investigation. (2019). *Crime in the United States, 2019: Table 45—Arrest trends in cities by sex, 2018–2019*. Criminal Justice Information Services Division. <https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/table-45>
- van den Heuvel, M. P., & Sporns, O. (2011). Rich-club organization of the human connectome. *The Journal of neuroscience: the official journal of the Society for Neuroscience*, 31(44), 15775–15786. <https://doi.org/10.1523/jneurosci.3539-11.2011>
- van den Heuvel, M. P., & Sporns, O. (2013). Network hubs in the human brain. *Trends in cognitive sciences*, 17(12), 683–696. <https://doi.org/10.1016/j.tics.2013.09.012>
- Van Essen, D. C., Smith, S. M., Barch, D. M., Behrens, T. E., Yacoub, E., Ugurbil, K., & WU-Minn HCP Consortium (2013). The WU-Minn Human Connectome Project: an overview. *NeuroImage*, 80, 62–79. <https://doi.org/10.1016/j.neuroimage.2013.05.041>
- Wagner, P., & Rabuy, B. (2017). Following the money of mass incarceration. *Prison Policy Initiative*. <https://www.prisonpolicy.org/factsheets/money2017.pdf>
- Weissman, D. G., Rosen, M. L., Colich, N. L., Sambrook, K. A., Lengua, L. J., Sheridan, M. A., & McLaughlin, K. A. (2022). Exposure to violence as an environmental pathway linking low socioeconomic status with altered neural processing of threat and adolescent psychopathology. *Journal of Cognitive Neuroscience*, 34(10), 1892–1905. https://doi.org/10.1162/jocn_a_01825
- Wong, T. Y., Sid, A., Wensing, T., Eickhoff, S. B., Habel, U., Gur, R. C., & Nickl-Jockschat, T. (2019). Neural networks of aggression: ALE meta-analyses on trait and elicited aggression. *Brain structure & function*, 224(1), 133–148. <https://doi.org/10.1007/s00429-018-1765-3>
- Yoder, K. J., Harenski, C., Kiehl, K. A., & Decety, J. (2015). Neural networks underlying implicit and explicit moral evaluations in psychopathy. *Translational Psychiatry*, 5, e625. <https://doi-org.libproxy.txstate.edu/10.1038/tp.2015.117>