LOG ID	BOOK REFERENCE	RCT FILTER	CONFIDENCE TIER
SEC 8.1.4	CHAPTER 8: COGNITIVE DOWNCLOCK (10 Bits vs. 1 Billion)	OFF	CONSENSUS

AUDITED CLAIM

GNWT ROUTING ALGORITHM (DARWINIAN PRIORITY)

SYSTEMS MODEL — AS STATED IN THE BOOK

> Clinically, while perceived threats do not universally override all conscious processing, trauma-related neural signals and conditioned fear cues receive severe **preferential attention allocation**; they rapidly capture **early orienting networks** and disrupt ongoing cognitive tasks.

VALIDATION QUERY

Do trauma-related neural signals and conditioned fear cues receive preferential attention allocation, capturing early orienting networks and disrupting ongoing cognitive tasks?

EMPIRICAL FINDING

Electrophysiological and eye-tracking measures show that conditioned fear cues and trauma-relevant signals capture human attention priorities. While threat does not automatically capture all conscious attention in every context, these highly salient threat signals rapidly capture early orienting networks and disrupt ongoing tasks.

PRIMARY ANCHORS

- → **Armony & Dolan, 2002, Neuropsychologia**
- → **Sperl et al., 2020, NeuroImage**

ABOUT THIS RECORD

Each claim in the book is decompiled from its IT metaphor into a naked, falsifiable scientific claim, then anchored to a **primary peer-reviewed source**. Claim and anchor are queried against the Consensus academic database (200M+ papers) under a fixed protocol — top-tier **Q1/Q2 journals only**, preprints excluded, human studies only. If a hypothesis fails the audit, the build is rejected: the AI generates the syntax; the peer-reviewed grid validates the physics.

CONFIDENCE TIERS

- **CONSENSUS ◀ this log** — broadly established, highly replicated mechanics.
- **EMERGING** — plausible, actively researched; no universal consensus yet.
- **EXPERIMENTAL** — contested, extrapolated, or purely theoretical.

RCT FILTER — Controlled Studies is ON for interventions (a forced action must beat a control) and OFF for mechanisms (so foundational neuroscience isn't blocked).

Yes, **trauma-related cues** and **conditioned fear signals** often capture attention early and can impair ongoing cognition.

1. Introduction

Across trauma, PTSD, and fear-conditioning research, the central answer is yes: threat-relevant and fear-conditioned cues often receive preferential attention, recruit early orienting and salience-related systems, and interfere with concurrent task performance. Foundational behavioral and neuroimaging studies showed that conditioned threat cues can speed detection and bias spatial orienting while engaging frontal-parietal attention regions (Armony & Dolan, 2002). In PTSD, threat-biased attention is associated with heightened fear expression, altered prefrontal and cingulate recruitment, and poorer allocation of cognitive resources to non-threat information (Fani et al., 2011; Fani et al., 2012).

The pattern is not uniform across all stages of attention. Eye-tracking reviews find the strongest and most consistent PTSD signal in sustained attention to threat rather than in facilitated initial detection (Lazarov et al., 2018). ERP and conditioning studies, however, show that early sensory-perceptual components such as P1, N1, N170, and related markers are often potentiated by threat and fear-conditioned stimuli, indicating capture at early orienting stages as well (Gupta et al., 2019; Sperl et al., 2020; Bruchmann et al., 2022). Trauma exposure across development also appears to recalibrate attention toward threat-related information, sometimes alongside broader impairments in cognitive control and threat-safety discrimination (McLaughlin et al., 2020; Michalek et al., 2022; Schäfer et al., 2022).

Do trauma-related neural signals and conditioned fear cues receive preferential attention allocation, capturing early orienting networks and disrupting ongoing cognitive tasks?

N = 11

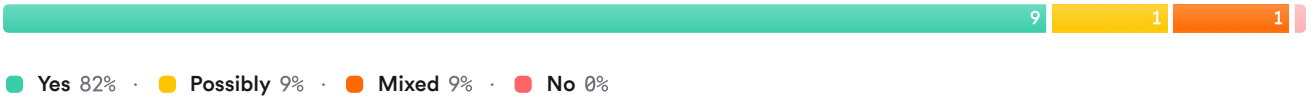

FIGURE 1 Consensus on trauma and conditioned threat attention capture

The meter should lean yes, but with an important qualifier: early orienting effects are robust in conditioning and electrophysiology, whereas PTSD-specific evidence for initial detection is more mixed than evidence for sustained monitoring and interference (Lazarov et al., 2018; Miller et al., 2020).

2. Methods

This Deep Search synthesis was run over more than 170 million research papers indexed in Consensus, including Semantic Scholar, PubMed, and related sources. The workflow identified 14,377 papers in the initial query, expanded through targeted searches and citation crawling, screened 239 papers with machine-learned relevance filtering, retained 164 eligible papers after deduplication and thresholding, and included the top 50 most relevant human studies for final synthesis.

Search Strategy

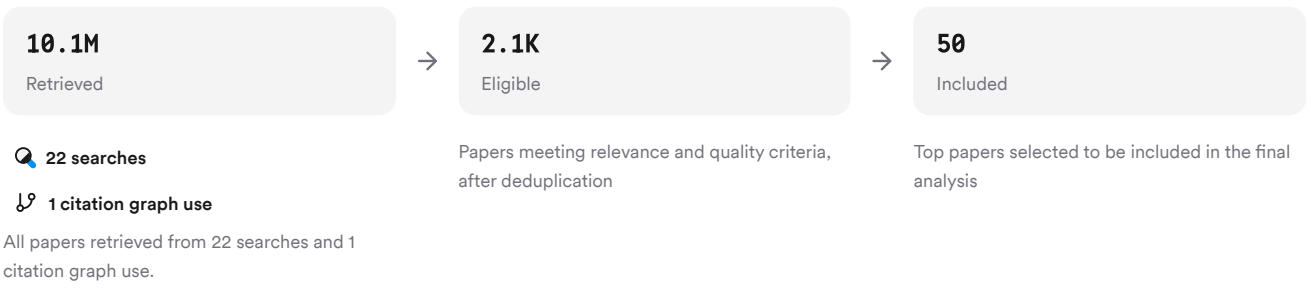

FIGURE 2 Deep search paper identification and screening flow

The search combined foundational models, alternate terminology, mechanistic studies, null findings, adjacent constructs, and developmental perspectives.

3. Results

3.1 Key Papers

Several papers anchor this literature because they connect behavior, neural timing, and task disruption across trauma and conditioning paradigms. Armony and Dolan established that fear-conditioned cues modulate spatial attention and recruit frontal-parietal orienting circuitry, while Fani and colleagues linked threat bias in PTSD to exaggerated fear expression and altered attentional control networks (Armony & Dolan, 2002; Fani et al., 2011; ■ Fani et al., 2012).

Paper	Summary
(■ Lazarov et al., 2018)	Conditioned threat modulates spatial attention networks (Armony & Dolan, 2002)
(Armony & Dolan, 2002)	Threat bias tracks exaggerated fear load in PTSD (Fani et al., 2011)
(Dou et al., 2021)	Threat cues recruit control and appraisal circuits (■ Fani et al., 2012)

FIGURE 3 Foundational papers anchoring this literature

3.2 Early Orienting Networks

Early-stage capture by threat cues is well supported in conditioning and ERP studies. Fear conditioning potentiates very early EEG responses beginning as early as 33-60 ms and extending through 108-200 ms, consistent with prioritized sensory processing and selective attention to danger signals (Sperl et al., 2020). Fear-conditioned faces also elicit increased P1 even when presented peripherally, indicating that early orienting enhancements are not limited to foveal stimuli (Bruchmann et al., 2022).

Dimension	Conditioned Fear Cues	Trauma/PTSD Cues	Citations
Early sensory ERP	P1/C1 potentiation	P1/N1 alterations	(Sperl et al., 2020; Stevens et al., 2025)
Spatial orienting	Faster valid-cue responses	Mixed early detection	(Armony & Dolan, 2002; ■ Lazarov et al., 2018)
Visual cortex engagement	Enhanced early processing	Enhanced trauma-cue tuning	(Armony & Dolan, 2002; ■ Todd et al., 2015)
Attention networks	Frontal-parietal recruitment	Salience and control alterations	(Armony & Dolan, 2002; Ely et al., 2023)

FIGURE 4 Early orienting effects across conditioning and trauma studies

Early capture is therefore strongest in controlled conditioning paradigms and in neural measures with millisecond resolution.

3.3 Ongoing Task Disruption

Trauma- and threat-related cues also disrupt concurrent cognitive performance. In emotional attentional blink, combat and disgust distractors impaired target detection in trauma-exposed veterans relative to neutral distractors, showing that emotional distractors consume processing resources needed for ongoing tasks (Olatunji et al., 2022). In PTSD, trauma-related words produce attentional interference rather than faster threat detection, supporting the view that disruption often reflects difficulty disengaging from trauma cues (Pineles et al., 2009).

Participants with PTSD also show poorer performance on affective Stroop paradigms, especially in emotional contexts, along with lower cognitive-control network activation and greater salience-network recruitment (Fani et al., 2019). Mechanistically, disproportionate allocation of control resources to trauma-relevant information is proposed to impair working memory and mental efficiency by leaving fewer resources for other task demands (Fani et al., 2012).

3.4 Heterogeneity and Boundary Conditions

The literature is not a simple hypervigilance story. A systematic review of PTSD eye-tracking studies found little support for enhanced threat detection or early hypervigilance, but consistent evidence for sustained attention maintenance on threat (Lazarov et al., 2018). A recent eye-tracking study similarly found longer dwell on negatively valenced stimuli in trauma-exposed groups, but no group differences in first-fixation latency or location, again pointing to stronger maintenance than initial orienting effects (Lazarov et al., 2021).

Task goals also matter. In healthy participants, fearful-face N170 and behavioral bias were suppressed when the emotional stimulus was irrelevant to task goals, showing that top-down demands can blunt early threat capture (Dou et al., 2021). Some PTSD studies even report attentional avoidance under high visual competition, suggesting that cognitive load and stimulus context can shift the observed pattern from vigilance to avoidance (Blekić et al., 2025).

Results Timeline

Threat-attention research has progressed from basic conditioning effects to network-level and developmental models.

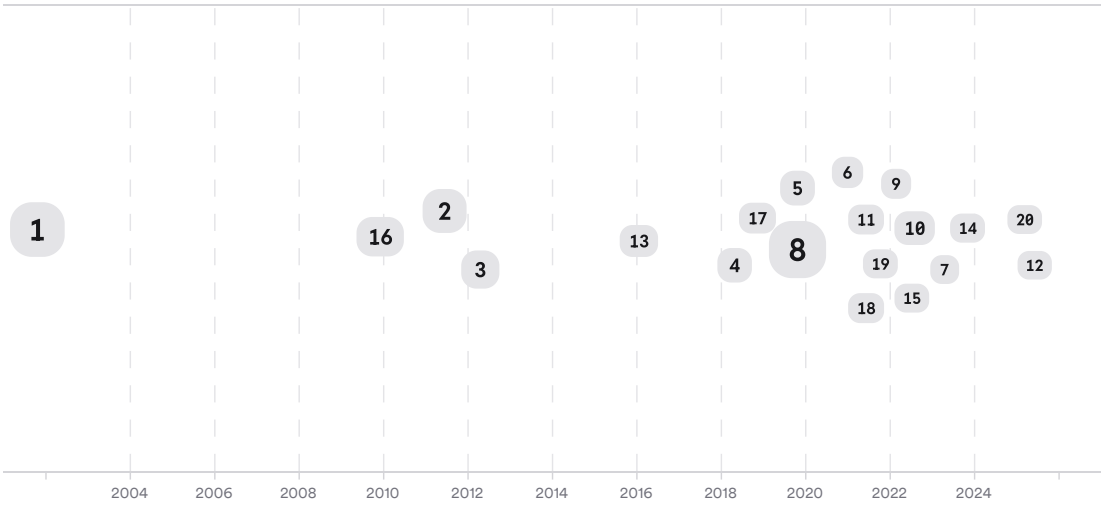

FIGURE 5 Timeline of trauma and fear attention findings; larger markers indicate more citations

Early work established conditioned-threat orienting and PTSD neurocircuit models (Armony & Dolan, 2002; Rauch et al., 2006). Later studies refined the picture with eye tracking, ERPs, large-network fMRI, and developmental cohorts showing sustained attention, fear generalization, and impaired cognitive control in trauma-exposed groups (Lazarov et al., 2018; Wen et al., 2022; Weissman et al., 2019).

Top Contributors

Within this corpus, a small set of authors appears repeatedly across PTSD, trauma-exposure, and conditioning studies.

Type	Name	Papers
Author	K. McLaughlin	[229c87793d6b5088949983e877746f92][e42cfbe0d1615b5f8fd650542be271de] [6a09bc72e92f52ceb56876337b7783ff][d0a48f28bf6555ddaa07788cea09e5dd] [d1b5bfcf7364512cb6742a930bb52231]
Author	Negar Fani	[75db354378d959269e276e48f231e884][0681e780d2f3536c84c8963dd21e6d33] [37001aa32ed050098ef5eb1fd8276d5e][65affb20087f5d93ac0ab83c81c62c3a]
Author	Y. Bar-Haim	[7ce3498c607057bfbf07cab57c44ec95][10c97601307f5eda882e1569d3ec8b5a] [1cc34323d2c65bcb9f8898187b9e0bac][e46187e222ef5ec998540d83635b5b9a]
Journal	*Psychological Medicine*	[75db354378d959269e276e48f231e884][7ce3498c607057bfbf07cab57c44ec95] [1cc34323d2c65bcb9f8898187b9e0bac]
Journal	*Translational Psychiatry*	[4a5bd15cf8ff5fdab15a3334c4b079a4][4515c2d3428b55a78f28ab44276a86be] [c36fcfea29bc593692d97efe99380363][3d0e23bdc0815426a596970501c6ff12]
Journal	*Biological Psychiatry*	[b39e85ee0caf528580b9a1bc354f1eaa][cbd176cc39295677a9487d835a2af719]

FIGURE 6 Authors and journals appearing most in included papers

4. Discussion

The strongest evidence supports two linked claims: conditioned and trauma-related threat cues often receive prioritized processing, and PTSD is associated with inefficient allocation of attention and control resources when emotional distractors are present. This conclusion is strengthened by convergence across methods: conditioning experiments, eye tracking, ERPs, MEG, task fMRI, resting-state connectivity, and meta-analytic reviews all point toward heightened processing of threat-related information (Armony & Dolan, 2002; Clauss et al., 2022; Miller et al., 2020; Sripada et al., 2012).

The key limitation is heterogeneity in what "attention bias" means across paradigms. Dot-probe tasks often yield mixed evidence for initial detection, whereas eye tracking more consistently detects sustained dwell, and ERPs more clearly reveal early neural potentiation (Lazarov et al., 2018; Gupta et al., 2019). PTSD-specific effects also vary by symptom domain, stimulus type, and cognitive load; avoidance, hyperarousal, and dysphoria can map onto different early neural responses, and some tasks reveal avoidance rather than vigilance (Stevens et al., 2025; Fani et al., 2019; Blekić et al., 2025).

Developmental and longitudinal work suggests these biases are not just epiphenomena. Childhood trauma is associated with threat-prioritizing social information processing, altered fear learning, and later psychopathology risk, while reduced dACC response to fearful faces prospectively predicts broader psychopathology increases (McLaughlin et al., 2020; Machlin et al., 2019; Weissman et al., 2019). At the same time, resilience studies indicate that more adaptive engagement of attention networks after trauma may buffer against chronic symptoms, implying that not all increased attention to threat is maladaptive in all phases or individuals (Roeckner et al., 2021).

Claim	Evidence Strength	Reasoning	Papers
Trauma- and fear-related cues often receive preferential attention.	Strong	Supported across conditioning, eye-tracking, ERP, and review literatures.	(Armony & Dolan, 2002; Clauss et al., 2022; Lazarov et al., 2018)

Claim	Evidence Strength	Reasoning	Papers
Early orienting networks are engaged by conditioned threat cues.	Strong	Multiple neural studies show early ERP and frontoparietal orienting effects.	(Armony & Dolan, 2002; Sperl et al., 2020; Bruchmann et al., 2022)
PTSD disrupts ongoing cognition mainly in emotional contexts.	Moderate	Consistent affective Stroop and interference findings, but task dependence remains.	(Fani et al., 2019; Pineles et al., 2009)
Early facilitated detection in PTSD is stronger than sustained attention.	Weak	Eye-tracking reviews argue the opposite, with limited support for early hypervigilance.	(Lazarov et al., 2018)
Threat-related attention patterns vary with goals, load, and symptom profile.	Moderate	Several studies show modulation by task relevance, avoidance, and symptom cluster.	(Dou et al., 2021; Stevens et al., 2025; Blekić et al., 2025)

FIGURE 7 Key claims and supporting evidence strengths

5. Conclusion

Taken together, the literature supports a qualified yes. Trauma-related signals and conditioned fear cues often receive preferential attention, especially in early sensory-orienting systems and sustained monitoring, and they can impair ongoing cognitive performance by diverting resources from task goals (Sperl et al., 2020; Olatunji et al., 2022; Fani et al., 2019). The clearest uncertainty is not whether threat matters, but when it appears as rapid capture, prolonged dwell, fluctuating vigilance, or avoidance.

Research Gaps

The main gaps concern timing, generalizability, and mechanism. The corpus is rich in cross-sectional adult PTSD studies and much thinner in longitudinal, developmental, and task-comparative work.

Topic/Outcome	RCT/Experimental Control	Longitudinal Data	Developmental Samples	Real-World Generalization
Early orienting to conditioned cues	10	2	3	2
Sustained attention in PTSD	8	2	2	3
Cognitive task disruption by trauma cues	6	1	2	2
Fear generalization and extinction	9	2	4	2

Open Research Questions

Future work should test when early capture becomes maladaptive and when attention-network engagement is protective rather than pathological.

Question	Why
When does early post-trauma attention to threat predict recovery versus chronic PTSD?	Resilience studies suggest attentional engagement can be adaptive early after trauma, but prospective evidence remains sparse.
Which task features determine whether PTSD shows vigilance, interference, or avoidance?	Mixed findings likely reflect differences in load, stimulus relevance, and competition, not a single underlying process.
Can changes in P1/N1/N170 markers mediate cognitive improvement after treatment?	ERP studies identify early sensory-attention alterations, but few longitudinal intervention studies test whether changing them improves symptoms or cognition.

In sum, trauma-related neural signals and conditioned fear cues do receive preferential attention allocation, but the most reproducible phenotype is a mix of early neural prioritization and sustained, task-disruptive threat processing rather than uniform hypervigilant detection alone.

References

Armony, J., & Dolan, R. (2002). Modulation of spatial attention by fear-conditioned stimuli: an event-related fMRI study.. *Neuropsychologia, 40 7*, 817-26. https://doi.org/10.1016/s0028-3932(01)00178-6

Blekić, W., Rossignol, M., & D'Hondt, F. (2025). Examining attentional avoidance in post-traumatic stress disorder: an exploratory 'Face in the Crowd' paradigm using eye-tracking. *European Journal of Psychotraumatology, 16*. https://doi.org/10.1080/20008066.2025.2462489

Bruchmann, M., Fahnemann, K., Schindler, S., Busch, N., & Straube, T. (2022). Early neural potentiation to centrally and peripherally presented fear-conditioned faces.. *Psychophysiology*, e14215. https://doi.org/10.1111/psyp.14215

Clauss, K., Gorday, J. Y., & Bardeen, J. R. (2022). Eye tracking evidence of threat-related attentional bias in anxiety- and fear-related disorders: A systematic review and meta-analysis.. *Clinical psychology review, 93*, 102142. https://doi.org/10.1016/j.cpr.2022.102142

Dou, H., Liang, L., J., Lu, J., Zhang, W., & Li, Y. (2021). Irrelevant task suppresses the N170 of automatic attention allocation to fearful faces. *Scientific Reports, 11*. https://doi.org/10.1038/s41598-021-91237-9

Ely, S. L., Zundel, C. G., Gowatch, L. C., Evanski, J., Bhogal, A., Carpenter, C., Shampine, M., & Marusak, H. A. (2023). Attention, attention! Posttraumatic stress disorder is associated with altered attention-related brain function. *Frontiers in Behavioral Neuroscience, 17*. https://doi.org/10.3389/fnbeh.2023.1244685

Fani, N., Tone, E. B., Phifer, J., Norrholm, S., Bradley, B., Ressler, K., Kamkwalala, A. R., & Jovanovic, T. (2011). Attention bias toward threat is associated with exaggerated fear expression and impaired extinction in PTSD. *Psychological medicine, 42*, 533 - 543. https://doi.org/10.1017/s0033291711001565

Fani, N., Jovanović, T., Ely, T., Bradley, B., Gutman, D., Tone, E. B., & Ressler, K. (2012). Neural Correlates of Attention Bias to Threat in Post-traumatic Stress Disorder. *Biological psychology, 90*, 134 - 142. https://doi.org/10.1016/j.biopsycho.2012.03.001

Fani, N., King, T. Z., Clendinen, C. A., Hardy, R., Surapaneni, S., Blair, J., White, S., Powers, A., Ely, T., Jovanović, T., Ressler, K., & Bradley, B. (2019). Attentional control abnormalities in posttraumatic stress disorder: Functional, behavioral, and structural correlates. *Journal of affective disorders, 253*, 343 - 351. https://doi.org/10.1016/j.jad.2019.04.098

Gupta, R. S., Kujawa, A., & Vago, D. R. (2019). The Neural Chronometry of Threat-Related Attentional Bias: Event-Related Potential (ERP) Evidence for Early and Late Stages of Selective Attentional Processing. *International journal of psychophysiology : official journal of the International Organization of Psychophysiology, 146*, 20 - 42. https://doi.org/10.1016/j.ijpsycho.2019.08.006

Lazarov, A., Suarez-Jimenez, B., Tamman, A., Falzon, L., Zhu, X., Edmondson, D., & Neria, Y. (2018). Attention to Threat in Posttraumatic Stress Disorder as Indexed by Eye-Tracking Indices: A Systematic Review. *Psychological medicine, 49*, 705 - 726. https://doi.org/10.1017/s0033291718002313

Lazarov, A., Suarez-Jimenez, B., Zhu, X., Pine, D., Bar-Haim, Y., & Neria, Y. (2021). Attention allocation in posttraumatic stress disorder: an eye-tracking study. *Psychological medicine, 52*, 3720 - 3729. https://doi.org/10.1017/s0033291721000581

Machlin, L. S., Miller, A., Snyder, J., McLaughlin, K., & Sheridan, M. (2019). Differential Associations of Deprivation and Threat With Cognitive Control and Fear Conditioning in Early Childhood. *Frontiers in Behavioral Neuroscience, 13*. https://doi.org/10.3389/fnbeh.2019.00080

McLaughlin, K., Colich, N. L., Rodman, A., & Weissman, D. G. (2020). Mechanisms linking childhood trauma exposure and psychopathology: a transdiagnostic model of risk and resilience. *BMC Medicine, 18*. https://doi.org/10.1186/s12916-020-01561-6

Michalek, J. E., Lisi, M., Binetti, N., Ozkaya, S., Hadfield, K., Dajani, R., & Mareschal, I. (2022). War-related trauma linked to increased sustained attention to threat in children. *Child Development, 93*, 900 - 909. https://doi.org/10.1111/cdev.13739

Miller, L. N., Simmons, J., Whittle, S., Forbes, D., & Felmingham, K. (2020). The Impact of Posttraumatic Stress Disorder on Event-Related Potentials in Affective and Non-Affective Paradigms: A systematic review with meta-analysis.. *Neuroscience and biobehavioral reviews*. https://doi.org/10.1016/j.neubiorev.2020.12.027

Olatunji, B., Liu, Q., Zald, D., & Cole, D. (2022). Emotional induced attentional blink in trauma-exposed veterans: associations with trauma specific and nonspecific symptoms.. *Journal of anxiety disorders, 87*, 102541. https://doi.org/10.1016/j.janxdis.2022.102541

Pineles, S., Shipherd, J., Mostoufi, S., Abramovitz, S. M., & Yovel, I. (2009). Attentional biases in PTSD: More evidence for interference.. *Behaviour research and therapy, 47 12*, 1050-7. https://doi.org/10.1016/j.brat.2009.08.001

Rauch, S., Shin, L., & Phelps, E. (2006). Neurocircuitry models of posttraumatic stress disorder and extinction: human neuroimaging research--past, present, and future.. *Biological psychiatry, 60 4*, 376-82. https://doi.org/10.1016/j.biopsych.2006.06.004

Roeckner, A. R., Oliver, K., Lebois, L., Van Rooij, S. V., & Stevens, J. S. (2021). Neural contributors to trauma resilience: a review of longitudinal neuroimaging studies. *Translational Psychiatry, 11*. https://doi.org/10.1038/s41398-021-01633-y

Schäfer, J., McLaughlin, K., Manfro, G., Pan, P., Rohde, L., Miguel, E., Simioni, A., Hoffmann, M., & Salum, G. (2022). Threat and deprivation are associated with distinct aspects of cognition, emotional processing and psychopathology in children and adolescents. *Developmental science, 26*, e13267 - e13267. https://doi.org/10.1111/desc.13267

Sperl, M. F. J., Wroblewski, A., Mueller, M., Straube, B., & Mueller, E. M. (2020). Learning dynamics of electrophysiological brain signals during human fear conditioning. *NeuroImage*, 117569. https://doi.org/10.1016/j.neuroimage.2020.117569

Sripada, R., King, A., Welsh, R., Garfinkel, S., Wang, X., Sripada, C., & Liberzon, I. (2012). Neural Dysregulation in Posttraumatic Stress Disorder: Evidence for Disrupted Equilibrium between Salience and Default Mode Brain Networks. *Psychosomatic medicine, 74*, 904 - 911. https://doi.org/10.1097/psy.0b013e318273bf33

Stevens, K. L., Marquardt, C. A., Tong, M. A., Davenport, N., & Sponheim, S. (2025). Posttraumatic stress symptomatology rather than mild traumatic brain injury is related to atypical early neural processing during cognitive control. *Neuropsychology, 39*, 503 - 516. https://doi.org/10.1037/neu0001008

Todd, R., MacDonald, M., Sedge, P., Robertson, A., Jetly, R., Taylor, M. J., & Pang, E. (2015). Soldiers With Posttraumatic Stress Disorder See a World Full of Threat: Magnetoencephalography Reveals Enhanced Tuning to Combat-Related Cues.. *Biological psychiatry, 78 12*, 821-9. https://doi.org/10.1016/j.biopsych.2015.05.011

Weissman, D. G., Jenness, J., Colich, N. L., Miller, A., Sambrook, K. A., Sheridan, M., & McLaughlin, K. (2019). Altered Neural Processing of Threat-Related Information in Children and Adolescents Exposed to Violence: A Transdiagnostic Mechanism Contributing to the Emergence of Psychopathology RH = Neural Threat Violence Psychopathology. *Journal of the American Academy of Child and Adolescent Psychiatry, 59*, 1274 - 1284. https://doi.org/10.1016/j.jaac.2019.08.471

Wen, Z., Seo, J.-H., Pace-Schott, E., & Milad, M. (2022). Abnormal dynamic functional connectivity during fear extinction learning in PTSD and anxiety disorders. *Molecular Psychiatry, 27*, 2216 - 2224. https://doi.org/10.1038/s41380-022-01462-5