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# PTSD and Olfaction

The Aetiology of PTSD and the Bidirectional  
Relationship between Trauma and Sensitisation.

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By

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## ABSTRACT

Olfactory Identification deficits are a typical characteristic of neurological disorders and often predate their onset (e.g., Schizophrenia, Parkinson's and Alzheimer's disease). Vasterling, Brailey and Sutker (2000) investigated Vietnam veterans and found that those with Posttraumatic Stress Disorder (PTSD) had Olfactory Identification deficits. Dileo, Brewer, Hopwood, Anderson and Creamer (2008) replicated these results.

This study tested the hypothesis that olfactory deficits predict the onset of PTSD in trauma survivors. Results may inform the viability of olfactory testing as a screening tool in predicting vulnerability to PTSD.

In this prospective cohort study, patients were selected from trauma admissions to the Royal Adelaide Hospital over a 24-month period. A total of 202 injured patients were assessed during hospital admission (Time 1) and followed up at 3 months (Time 2) and 12 months (Time 3). Assessment of PTSD was with the Clinician-Administered PTSD Scale and Olfactory Functioning via the "Sniffin' Sticks" method. Tests of olfaction included Threshold, Identification and Discrimination. A binomial Generalized Estimating Equation (GEE) with logit link and logistic regression models was used to examine the relationship between Olfaction and PTSD over time.

The results contradicted the hypothesis and suggest that:

- High Olfactory Threshold at Time 1 is a predictive measure of PTSD at Time 2 and at Time 3 for females. Thus, females are more prone to PTSD if they have a high Olfactory Threshold but this relationship also existed for males at Time 2.
- High Olfactory Identification scores are significantly related to PTSD at Time 2 and Time 3. This suggests that individuals who demonstrate superior Olfactory

Identification are at increased risk of conditioning and sensitisation and following the onset of PTSD, experience a further escalation in olfactory acuity.

These results may be explained by the ‘increasing sensitisation model’ of PTSD which contends that PTSD is not an immutable, fixed condition, but dynamic and involving escalating neuropsychobiological processes (McFarlane, 2010). This escalation is mediated by neurohormonal and neuroanatomical dysfunction (van der Kolk, 1997) which influences the limbic system. Due to the extensive shared neurophysiology of the limbic and olfactory systems, much of the escalating neuropsychobiological process can be observed via olfactory functioning. Thus, olfaction becomes a window to the brain.

The dynamic relationship between olfaction and PTSD reflects this escalating nature. The likely precipitating factors behind this progression are sensitisation and kindling. Specifically a primary vulnerability marker in the development of PTSD is sensitivity to the environment. This is indicated by initial high Olfactory Threshold, which predicts PTSD. This phase in the PTSD sequence could be termed prodromal sensitisation. Following trauma those most vulnerable experience additional sensitisation until an episode of PTSD is precipitated. Once diagnosed with PTSD, kindled responses precipitate further sensitisation as demonstrated by increased Olfactory Identification and Threshold. This phase could be termed major sensitisation.

Thus, this study confirms the observation of a comorbid bidirectional relationship between trauma and sensitisation in the aetiology and development of PTSD.

The significant relationship between olfaction and PTSD means that olfactory testing has potential application in screening and prevention.

## DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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William Graham Hough

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Olfaction is a profoundly complex, mysterious yet nuanced subject with many paradoxes. That Olfaction is related to PTSD is rather curious. Subtle is the Lord.