



End Violence Against Women International  
(EVAWI)

# Important Things to Get Right About the “Neurobiology of Trauma”

## Part 1: Benefits of Understanding the Science

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September 2020

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## **Recommended Citation**

Hopper, J. (2020). *Important Things to Get Right, and Avoid Getting Wrong, About the “Neurobiology of Trauma.” Part 1: Benefits of Understanding the Science*. End Violence Against Women International.

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**Dr. Kimberly A. Lonsway** has served as the Director of Research for EVAWI since 2004. Her research focuses on sexual violence and the criminal justice and community response system, and she has written over 60 published articles, book chapters, technical reports, government reports, and commissioned documents – in addition to numerous training modules, bulletins, and other resources. Over her career, she has trained thousands of professionals across the country and around the world, in a diverse array of disciplines and settings, and volunteered for over 15 years as a victim advocate; in 2012, she was awarded the first-ever Volunteer of the Decade Award from the Sexual Assault Recovery and Prevention (SARP) Center in San Luis Obispo, CA. She earned her PhD in the Department of Psychology at the University of Illinois, Urbana-Champaign.



**Sgt. Joanne Archambault** (Retired, San Diego Police Department) is the Chief Executive Officer for EVAWI. Prior to founding EVAWI in 2003, Sgt. Archambault worked for the San Diego Police Department for almost 23 years, in a wide variety of assignments. During the last 10 years of her service, she supervised the Sex Crimes Unit, which had 13 detectives and was responsible for investigating approximately 1,000 felony sexual assaults each year. Sgt. Archambault has provided training for tens of thousands of practitioners, policymakers, and others – both across the country and around the world. She has been instrumental in creating systems-level change through individual contacts, as well as policy initiatives and recommendations for best practice.



This training bulletin series was written to explore some central concepts in the “neurobiology of trauma,” as it is understood by people working with sexual assault victims. Understanding essential scientific findings and avoiding any misinterpretation or misapplication can help professionals work more effectively with survivors. But before I do that, I want to briefly explain my experience and qualifications in this area.

## Background

I am a clinical psychologist by training and an expert in psychological trauma, especially trauma resulting from interpersonal violence.<sup>1</sup> Since the mid-1990s, I have studied the scientific literature on how stress and trauma can impact neurobiological processes that underlie attention, thinking, behavior, and memory processes. I have also personally conducted research on the neurobiology of trauma and traumatic memories. Since the early 2000s, my affiliation with Harvard Medical School has given me easy access to a vast number of scientific publications, allowing me to track historical and emerging trends and also to connect with top-flight neuroscientists from around the world, some of whom have reviewed my writing and teaching or sought my input on their research.

I am also a therapist, and my website draws many sexual assault survivors seeking help, so I have heard directly from numerous people about their personal experiences of being physically or sexually assaulted, and their memories of these experiences. As an expert witness, I have reviewed many recordings and transcripts of interviews with investigators who either have – or lack – scientifically sound knowledge and realistic expectations about survivors’ thinking, behavior, and memories. This can have a *huge* effect on the way questions are asked, how well survivors’ answers are listened to and understood, and the quality of the information collected and documented in their reports.

Based on those experiences and knowledge, I work to educate people – professionals, survivors, and others – on the neurobiology of trauma in the most scientifically sound and practically useful ways I can. In doing so, I have identified some over-simplifications and misunderstandings that can prevent professionals from understanding and working effectively with sexual assault survivors. I wrote this training bulletin series to address some of those over-simplifications and misunderstandings. I would like to start by clarifying what exactly we mean when we refer to the “neurobiology of trauma.”

## What is the “Neurobiology of Trauma?” What Isn’t It?

What the sexual assault field typically refers to as the “neurobiology of trauma” is actually a combination of various branches of brain science that help to explain common – but commonly misunderstood – ways that victims (a) respond during a sexual assault, (b) encode and store the experience in memory, and (c) recall these memories later.

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<sup>1</sup> The International Society for Traumatic Stress Studies (ISTSS) defines traumatic events as “shocking and emotionally overwhelming situations that may involve actual or threatened death, serious injury, or threat to physical integrity.” See <http://www.istss.org/public-resources/what-is-traumatic-stress.aspx>.

Yet this conceptualization includes only a small portion of the scientific research actually conducted on the neurobiology of psychological trauma.<sup>2</sup> As applied in the sexual assault field, the “neurobiology of trauma” framework draws primarily from research on (a) animal and human behavior under stressful or dangerous (not necessarily traumatic) conditions, and (b) the impacts of moderate (not traumatic) stress on human cognitive and memory processes. A great deal of scientific research is excluded from this discussion and framework. Therefore, **professionals who work in the sexual assault field should recognize that, scientifically speaking, “the neurobiology of trauma” involves much more than the focuses of their work and training, and they should not use the term as if it’s an all-encompassing explanation for *all victim behaviors and memories*.**



### What is Neurobiology?

Simply stated, neurobiology is the biological study of the nervous system. It is a multidisciplinary field that draws upon scientific disciplines including anatomy, physiology, molecular biology, mathematical modeling, and psychology to understand the fundamental and emergent properties of neurons (i.e., brain cells) and neural circuitries. Neurobiology helps to explain human experience, thinking, emotions, memories, and behavior in terms of brain structures and processes.

In addition, **some of the most important insights into the behaviors and memories of sexual assault victims are *not* based on neurobiology research, and many victim responses do not require scientific research to be understood appropriately.** For example, there are plenty of *psychological and social* reasons why most victims don’t physically resist during a sexual assault, why it often takes a while to tell someone about the assault or report it to law enforcement, and why many survivors maintain a relationship with a perpetrator. Many professionals in the field “understood” these victim behaviors, and responded appropriately, long before they knew anything about the “neurobiology of trauma.”

## Not Just Stress and Trauma

It is also helpful to recognize that stress and trauma cover a continuum, with mild stress at one end and traumatic stress at the other. For ethical reasons, scientists cannot (and do not want to) traumatize people in research experiments. So, there will never be

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<sup>2</sup> In the psychiatric, behavioral, cognitive, and brain sciences the “neurobiology of trauma” is a term that refers to many different issues, explored with many different types of research. Most of that scientific research has focused on *long-term* impacts of traumatic experiences on a variety of brain structures, circuitries, and processes, especially in people diagnosed with posttraumatic stress disorder (PTSD). Less commonly, scientists have also studied the neurobiology of dissociative disorders, major depression, and other psychiatric disorders that can occur after traumatic events. Many potential impacts of trauma (e.g., gene expression, hippocampal volume) are seldom, if ever included in professional trainings provided for law enforcement, prosecution, health care, victim advocacy, higher education, or the military.



studies of what is happening in the brains of people while they are being sexually assaulted. But *we do not need such studies* to understand a great deal about what happens in people’s brains during stressful or traumatic assaults – or during natural disasters, military combat, terrorist attacks, attacks by large predatory animals, etc.

This is because **the same brain structures and circuitries,<sup>3</sup> and the same chemical and electrical processes, are involved along the entire stress continuum (especially from moderate to traumatic stress), just to differing degrees.** This means that large bodies of scientific research – on how stress impacts (a) the brain’s prefrontal cortex and its “executive functions,”<sup>4</sup> (b) behavior,<sup>5</sup> and (c) memory encoding, storage, and retrieval<sup>6</sup> – are all valuable to the sexual assault field. They shed light on thoughts and behaviors that are common during the stress and trauma of a sexual assault experience, and on common characteristics of sexual assault memories.



For more information on the “neurobiology of trauma” and the implications for behaviors and memories of sexual assault victims, please see three prior training bulletins from EVAWI: (1) [Becoming Trauma Informed: Learning and Appropriately Applying the Neurobiology of Trauma to Victim Interviews](#); (2) [Trauma-Informed Interviewing and the Criminal Sexual Assault Case: Where Investigative Technique Meets Evidentiary Value](#); and (3) [Understanding the Neurobiology of Trauma and Implications for Interviewing Victims](#). Also available is a 2-part webinar series entitled, *Neurobiology of Sexual Assault* ([Part 1](#) and [2](#)).

## Benefits of Understanding the Science

When we understand the neurobiological basics of how people commonly respond while being sexually assaulted, and how stress and trauma can alter their memory processes, we reap many valuable benefits. These include more realistic expectations for victim responses during a sexual assault, more perceptive listening to their account of what happened, and more effective information-gathering about their memories and responses. But this knowledge should not be used to explain or make assumptions about any *particular* survivor’s responses or memories; each individual is unique.

<sup>3</sup> A brain “circuitry” is simply a collection of brain areas that work together to perform certain functions, and while the brain is not a computer, neuroscientists understand it has having many different circuitries.

<sup>4</sup> For reviews, see Arnsten, A.F.T. (2009). Stress signalling pathways that impair prefrontal cortex structure and function. *Nature Reviews Neuroscience*, 10, 410-422; Arnsten, A.F.T. (2015). Stress weakens prefrontal networks: molecular insults to higher cognition. *Nature Neuroscience*, 18, 1376-1385.

<sup>5</sup> For review, see Kozłowska, K., Walker, P., McLean, L. & Carrive, P. (2015). Fear and the defense cascade. *Harvard Review of Psychiatry*, 23 (4), 263-287.

<sup>6</sup> For reviews, see Hopper, J. (2018) “[Why incomplete sexual assault memories can be very reliable](#),” and “[Why Christine Blasey Ford can’t remember how she got home](#),” on my blog with *Psychology Today*.





## More Realistic Expectations

One primary benefit of understanding this science, and accurately explaining it, is to create more realistic expectations about how people tend to respond during sexual assault, and how they encode and store such experiences as memories. Whether you are a police officer or other responding professional, or a friend or family member of a survivor, this understanding can help you avoid any expectation that the survivor might have yelled, fought, or tried to run away during the assault, or that they might have complete and linear memories of the experience. Instead, we will be better prepared to understand that rational thinking tends to be quickly impaired, that behavior tends to be reflexive and habitual, that people often dissociate and go on autopilot, and that only some parts of the experience get encoded and stored in memory.

## More Perceptive Listening

A second benefit of understanding this science is to listen more perceptively to victim responses. For example, if we know the different types of freezing responses people can have, then we can recognize indicators of them when survivors say things like, “Suddenly I froze,” “My mind was blank,” or “All I could think was...”<sup>7</sup> If we know that stress and trauma can impair the decision making of the rational brain and shift a person toward habit-based behaviors, then we can recognize those behaviors for what they are, not as “failures” to respond rationally or effectively. If we know about tonic and collapsed immobility, we can recognize indicators of those reflexes, and know to gather more information about the person’s thoughts and other experiences in those states.

Finally, if we understand that dissociation can kick in at any time, leading the person to “space out” and not notice what’s happening to their body, then we won’t be surprised by missing pieces of memory due to dissociation at any point during the sexual assault. If we understand that habit behaviors can happen in dissociative “autopilot” mode, then we won’t be surprised that someone engaged in sex acts on autopilot, without wanting, choosing, or consenting.

The same is true for how we listen to people’s *memories*. If we know common characteristics of traumatic memories, we can recognize them in victim accounts: vivid central details; vague, inconsistent, and missing peripheral details; and missing time sequencing of details – especially later in the assault, when the memory circuitry tends to go into a minimal-encoding mode. **We’ll know to keep listening, without bias or assumptions about whatever else the victim may disclose, with greater confidence that we’re unlikely to miss or misunderstand valuable information.**

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<sup>7</sup> For a detailed explanation of “freezing” (from scientific and neurobiological perspectives), including how three different freezing responses can unfold over time (e.g., “detection freezing” and then “shocked freezing” in the initial seconds of a sexual assault, and “no-good-choices freezing” potentially following for seconds or even minutes into the experience), please see Hopper, J. (2018), “[Freezing during sexual assault and harassment](#),” Sexual Assault and the Brain (blog), *Psychology Today*.

## More Effective Information-Gathering

A third benefit is to improve the effectiveness of information-gathering from sexual assault victims. With an accurate understanding of this science, we are better equipped to collect detailed information about possible freezing responses, impaired reasoning capacities, habit behaviors, and survival reflexes – the very types of responses that have long been unrecognized and misunderstood, even misinterpreted as evidence that no assault happened, or that the sexual acts were consensual rather than forced or coerced.

We can also apply this knowledge to ask non-leading questions about central details, which often elicit remarkable and unexpected information that may line up with other evidence and make for very compelling testimony. We can avoid pushing for peripheral details that may never have been encoded, or may have rapidly faded from memory, and thereby prevent inaccuracies and inconsistencies that can be weaponized later. We can also be more careful when seeking time sequence information, especially later during the sexual assault, when the victim’s memory circuitry may not have had the capacity to encode and store some details about their experience, or how those details unfolded over time.

## Avoiding Specific Assumptions

These three benefits can be true game changers for law enforcement investigators, prosecutors, and other professionals who work with survivors. But there is a risk if people take unwarranted leaps from such general understanding to specific assumptions about any *particular* survivor’s responses to being sexually assaulted, or their memories of what happened during the experience.

For example, we shouldn’t assume that a person froze during their sexual assault, because not everyone does. We shouldn’t assume they suffered extreme prefrontal cortex impairment and lost all rational thinking capacities. And we shouldn’t assume that the only habit behaviors a person will engage in while being sexually assaulted are passive and ineffective. Nor should we assume that someone experienced tonic or collapsed immobility the moment they say something like, “I felt like I couldn’t move.”

Instead, we must keep our minds open and engage in careful listening. And again, we must ask open-ended, non-leading questions to gather more information and fill in the entire picture, which will often have unique, new, or surprising aspects. These techniques allow us to avoid imposing assumptions, old or new, on survivors.

## Next Up

With that general introduction in mind, I will provide more detailed information in the next two installments in this training bulletin series, focusing on two key topic areas: (1) Victim Responses During Sexual Assault and (2) Memory Retrieval or Recall.