Brain-based Effects: Vulnerability and Needs

- Whether people are reporting a recent sexual assault, or one from long ago, they are very vulnerable.
- They may be tormented by memories and reminders, emotionally ‘shut down’ and ‘numbed out’, or cycling between these extremes. **Be careful not to judge credibility based on emotional state.**
- Many symptoms and problems are **attempts to cope.** These include using substances – which may be attempts to escape terrible memories, anxiety, etc. – and compulsive or risky sexual behaviors, which may be attempts to gain a sense of mastery and control over one’s sexual experiences.
- Having to talk about the assault can **feel like having one’s ‘defenses’ battered down.** That stress can cause difficulties in recalling parts of the assault experience – even when sincerely trying – particularly parts that are disturbing, or about which one feels ashamed. Or, after disclosing such things, they may feel like they did during the assault: violated, overwhelmed, and re-traumatized.
- **Most important needs: safety, control, trust, understanding, and compassion.** Find ways to meet these needs within the boundaries of your role, including allowing them to recount what they remember first as an **uninterrupted narrative,** then asking (non-leading) follow-up questions. Even simple options and choices, like whether they want a drink, or when to take breaks, can help a lot – improving cooperation and results.

Brain-based Effects: Defense Circuitry in Control, Prefrontal Cortex Impaired, Running on Habits and Reflexes

- If someone is being sexually assaulted, as long as the person is conscious, even if intoxicated, at some point the **defense/fear circuitry will detect the attack and it will likely immediately dominate brain functioning.**
- Within seconds of the defense circuitry kicking in, the **prefrontal cortex will likely be impaired,** resulting in...
- **Bottom-up attention:** the defense circuitry, not the prefrontal cortex, dominates where attention goes.
- **Impairment of prefrontal cortex capacities** for rational thinking, planning effective responses, remembering important information (e.g., there are people nearby who would hear a scream), etc.
- **Reflex responses** that are hard-wired into human brains – because we evolved as prey, not just predators. These range from a **brief freeze response** when attack is detected (in which movement ceases and the brain assesses the attack and possible escape options), to **extreme survival reflexes** including **dissociation** (awareness is disconnected from emotions and body sensations, and one may go on ‘autopilot,’ including engaging in sex acts), **tonic immobility** (literally can’t move or speak and rigid muscles, **different from freeze**), and **collapsed immobility** (loss of oxygen to brain, ‘dizzy,’ even pass out, limp muscles).
- **Habit responses** that are rooted in social conditioning, e.g., how girls and women are socialized to respond to males’ unwanted sexual advances (in nice, polite, face-saving ways), in **habits for dealing with aggressive and dominant people,** and/or **habits learned to cope with childhood abuse.**

Brain-based Effects: Memories

- **Central details:** What attention was focused on during assault (by defense circuitry). Tend to be very well encoded and stored, and more likely to be accurate, consistent and corroborated (even by perpetrator). They may (at first) not seem central to the investigation (e.g., detailed description of a table or plant), but may be consistent with states of fear, stress and trauma, evidence of being in the described location, etc.
- **Peripheral details:** Details that did not get (much) attention, likely because defense circuitry didn’t see them as relevant to survival. Usually encoded into memory poorly or not at all, thus **recalled poorly and/or inconsistently over time.** Reason for “fragmentary” memories. May be a central focus of investigation (e.g., things perpetrator did), but ‘failure’ to recall such things **does not indicate lack of credibility** – only that they weren’t (well) encoded in the first place, as should be expected of a brain under attack (in combat too).
- **Contextual information** (e.g., the layout of a room) and **time-sequence information** (e.g., the order in which sexual acts occurred) are often poorly encoded. Again, an expected impact on a brain that’s under attack.
- **Experiences around the time when attack was detected** are usually well encoded. Attention is still required for encoding into memory, but because the hippocampus temporarily goes into a **super-encoding mode,** memories of when attack was detected may include substantial contextual and time-sequence information.
Sexual Assault and the Brain

Understanding the brain under attack, and implications for justice and healing.

Jim Hopper, Ph.D., is an expert in psychological trauma. He is an independent consultant and a teaching associate at Harvard Medical School.

Why Christine Blasey Ford Can't Remember How She Got Home

Stress and trauma have time-dependent effects on the hippocampus and memory, not just enhancing central over peripheral details, but eventually leading to a minimal-encoding phase.

Why Incomplete Sexual Assault Memories Can Be Very Reliable

Incomplete memories of sexual assault, including those with huge gaps, are understandable—if we learn the basics of how memory works and we genuinely listen to survivors.

Why It's Time for Sexual Assault Self-Defense Training

Not victim blaming, not just physical skills, but proven ways to resist assault and coercion, especially habits of owning sexual desires, values, and rights.

Freezing During Sexual Assault and Harassment

Understanding the neurobiology of freezing can be very helpful— in making sense of one’s own experiences, supporting others, and investigating or prosecuting.
Sexual Assault & the Brain

Available in English, Spanish and German, with other languages coming.

Why don't many people fight or yell when they're being raped?

Why are memories of sexual assault so often fragmentary and confusing?

Is the brain's response to attack essentially the same - controlled by the defense/fear circuitry, running on reflexes and habits - during sexual assault, physical assault, and military combat?

The answers have big implications for people who've been sexually assaulted, for those who investigate and prosecute such crimes, and for everyone else who knows or works with someone who's been sexually assaulted.
Understanding How Victims React to Trauma

It is fundamental that SARTs understand that when a person is harmed by a criminal act, the criminal justice system has a moral and legal obligation not only to seek justice but also to respond with respect and compassion to the unique needs of traumatized victims. [18] Research on trauma’s biological effects on the brain has yielded important insights. It is critical that SARTs recognize the powerful effect sexual assault may have on victims and integrate trauma-informed, culturally responsive, victim-centered approaches into their responses.

Service providers should be aware that when an attack is detected, the brain’s defense circuitry may —

1. rapidly take over,
2. immediately impair the rational part of the brain, and
3. trigger the release of habit and reflex behaviors.

These natural, brain-based habit and reflex responses determine the ways a victim behaves during an assault. Misunderstanding biological responses to attack, including sexual assault,
can result in additional trauma for the victim, undermine investigations, and prevent holding offenders accountable in court.

Being physically and emotionally violated during a sexual assault can cause states of intense fear, powerlessness, and hopelessness, in part because the internal resources that give individuals a sense of control, connection, and meaning are overwhelmed. [19]

This section of the SART Toolkit reviews brain-based and emotional responses to sexual assault, coping strategies, and a trauma-informed response to victims of sexual assault.

Brain-Based Responses to Trauma

Recent research has discovered common, brain-based responses to events the brain interprets as an attack, including sexual assault. This knowledge about how the brain processes threats and attacks has implications for sexual assault victims and the work of SARTs in building victim-centered services and supports.

It is impossible to understand the complex ways the brain works by referring to a few of its parts and their functions. But the brain’s response to an unsafe situation or attack can be greatly clarified through an understanding of the prefrontal cortex and the “defense circuitry.”

The prefrontal cortex is behind our foreheads and above our eyes. When the prefrontal cortex is fully functioning, it allows people to have thoughts and behaviors that are not simply based in habits and reflexes. For example, the prefrontal cortex allows us to focus our attention where we choose, based on our goals for a situation or interaction. The prefrontal cortex is what allows us to be “rational” by drawing on memories and plans, as well as reasoning capacities, to make decisions about how to respond to a situation or interaction.

The brain has a “defense circuitry” long referred to by scientists as the “fear circuitry” (including the amygdala), which is the most important circuitry for understanding how and why people respond to sexual assault, physical assault, combat, and other situations involving threat, attack, and other dangers. The defense circuitry continually monitors the environment for signs of danger, threat, or attack. When that circuitry detects an attack, within a second or two, it can dominate brain functioning. [20]
When the defense circuitry takes over, a person’s behavior is largely controlled by habits and reflexes, not behaviors chosen by the brain’s “rational” prefrontal cortex, which is rapidly impaired in situations of high stress or fear. This makes perfect sense: It takes time to think of rational responses - time that could mean the difference between life and death - but habits and reflexes can be accessed and deployed in less than a second, as any well-trained police officer or military service member knows.

The rapid responses by the “defense circuitry” often follow a pattern over time, beginning with reflexive freezing, followed by habits or other reflexes determined by how the defense circuitry is assessing the unfolding threat or attack.

*Freeze* is typically the first brain-based reflex response during a sexual assault. This is usually a brief response that kicks in when danger or attack is detected, in which movement is put on hold and the brain scans the environment to assess for danger and possibilities for escape.

For example, the freeze response can happen if a victim suddenly realizes that someone they trust is betraying that trust. Or it can occur when the victim realizes that someone does not care what the victim wants or does not want done to their body, and refuses to acknowledge, or will not listen to, any version of “no.”

Importantly, the initial and typically brief freeze response should not be confused with other reflex or habit responses that involve not moving. The initial freeze is an assessment, while specific defense and survival mechanisms (e.g., tonic immobility, as described below) may be implemented by a victim’s brain later in an assault.

After the initial freeze response passes (which could take just a second or two), the brain’s defense circuitry can rapidly select from a variety of other reflexive and habit-based response options. These reflexive or habit-based responses could include “fight” (physical resistance of some kind) or “flight” (attempting physically to escape), or fleeing. But fight and flight are not the typical responses of sexual assault victims, especially when they’re assaulted by someone they know and thought they could trust, which is most commonly the case.

> When a serious threat or attack is detected, the brain’s defense circuitry (1) rapidly takes over, (2) impairs the rational part of the brain, and (3) triggers the release of *habit* and *reflex* behaviors.
Everyone has habits of self-protection that are based in culture or times in their lives when they were abused, attacked, dominated, disempowered, or oppressed. For example, many cultures teach individuals to initiate and pressure others for sex. Some cultures teach responding to unwanted sexual advances with polite excuses (e.g., “it’s late,” “my partner will find out”) rather than saying “no.” In some cultures, individuals are taught “no” does not mean stop.

Victims of childhood sexual abuse may react to an adult sexual assault with the habits developed during the childhood abuse because those habits “worked” — not to stop the abuse, but to keep the victim alive or to prevent others from experiencing the same abuse. Old habits from traumatic childhoods often involve behaviors of submission and silence. Victims may say “no,” move away, ask to be brought home, suggest another activity, or otherwise indicate a lack of consent precisely because they are terrified, and their brain has no other habits (such as from sexual assault resistance training [24]) to draw upon.

Self-protection habits can come back, in a fraction of a second, once a sexual assault is detected by the brain’s defense circuitry, even if they have not have been activated for years. Too often, the habit behaviors employed during sexual assaults are later misunderstood or interpreted as evidence that no assault occurred, or that the sexual contact was wanted.

People who committed the assaults and defense attorneys often use the lack of education and clarity around habit responses to introduce doubt and claim that victims had “mixed feelings” at the time and only later claimed it was an assault because they regretted their behavior.

In other cases, the brain’s defense circuitry initiates extreme “survival reflexes,” also known as “defense responses,” [25] that have long enabled animals and humans to survive attacks by larger predators that want to eat them (or not feel pain while being killed). Unfortunately, when someone is being preyed upon sexually, these extreme survival reflexes render them even more vulnerable to the offender.

Commonly misunderstood extreme reflexes that occur during sexual assaults are described below. The most common is dissociation. Tonic immobility is less common, and collapsed immobility is least common of all but occurs in some cases.

- **Dissociation.** The brain disconnects conscious awareness from the terrible sensations and emotions that the sexual assault is causing in the body. The person “blanks out,”
or “spaces out,” and later may say they felt like they were “in a dream,” “in a movie,” or “disconnected from my body.”

- **Tonic immobility.** The person is literally paralyzed, unable to move or speak. Muscles are rigid and may tremble. The person may be fully aware of what’s happening to them, including horrific sensations and emotions, but utterly helpless to do anything to stop it, even to call for help. The person may simultaneously dissociate and not experience what’s being done to and happening in their body — typically, a state of total paralysis, but some victims report being able to slightly move parts of their body. Also, victims can quickly go into and out of this state, paralyzed one moment and able to move the next.

- **Collapsed immobility.** Due to sudden massive drops in heart rate and blood pressure that characterizes collapsed immobility, the brain receives less oxygen and the person feels faint and may completely pass out. They are also paralyzed, unable to move or speak, with the body limp or floppy (not rigid as in tonic immobility). Given the loss of oxygen to the brain and impacts on consciousness, it takes time to emerge from this state.

It is essential that service providers understand the brain-based responses to sexual assault so they can understand victim reactions and develop support and services that treat victims with fairness, respect, and dignity.

**Introduction to the Science of Stress, Trauma, and Memory**

To get the most accurate information about the assault, SART members, specifically investigators and prosecutors, should understand how victims may record information at the time of the assault and later remember it. When considering a victim interview strategy, you need to consider memory decay versus retrievability, and balance the potential costs and benefits of a single interview versus multiple interviews.

Investigators also need to consider what a stressed victim may be able to recall and share soon after an assault versus what the victim may be able to recall and share in an interview after adequate sleep. In light of emerging science and refined understanding of memory, law enforcement may begin to implement and evaluate multiple trauma-informed interviews. As
this is an emerging practice, SARTs are encouraged to seek up-to-date information from technical assistance providers on outcomes to ensure SARTs are implementing current best practices when interviewing victims.

Here are some reasonable implications of the research on memory, stress, sleep, and “retrieval practice”:

1. Victims who are still traumatized or very stressed after a sexual assault (or other trauma) will not be able to recall everything that was recorded by their brains, even when interviewed with the best and least stressful possible approach. At least two interviews over the span of several days may yield more information. More information from a victim may help investigators build a more robust criminal case. Investigators following trauma-informed interview practices, including asking open-ended questions, and not pushing for recall of peripheral details that may not have been encoded, can worry less about multiple interviews creating inconsistencies.

2. Aside from the impairing effects of stress on retrieval of memories (which are important), the longer one waits to interview a sexual assault victim, the less likely the victim is to remember peripheral details. Peripheral details are details from the assault that were not central focuses of attention or emotionally significant — yet could still be critical to the investigation and prosecution. Waiting for the victim to sleep is not going to help preserve those peripheral details in memory, unless before sleeping the victim has retrieved those details and their brain has tagged them as emotionally significant. [26]

3. The stress-reduction benefit of sleep could enable the retrieval of some information that was not accessible before the victim slept. This is particularly true for the memories that are most emotionally significant, which sleep helps to preserve, while emotionally insignificant information may continue fading and even be lost during sleep.

4. Even if the victim is too traumatized or stressed to recall some details in the first interview, those details that are retrieved in that first interview will be re-encoded and potentially “re-consolidated.” Especially for parts of the experience associated with less attention or little emotional significance during the assault, that first interview could preserve critical information that would otherwise be lost.

5. For all interviews with sexual assault victims, anything that significantly stresses victims will make it harder for them to retrieve whatever memories are still stored in their brains.
It is critical that SART members, including investigators and prosecutors, distinguish between central and emotionally significant details versus peripheral and less emotionally significant details. The former tend to have stronger encoding and sleep-promoted “consolidation” (or storage) and to be less easily distorted by poor interviewing or associated with inconsistencies. The latter tend to be poorly encoded, not consolidated by sleep, and vulnerable to confusion and inconsistencies despite sincere and honest efforts of victims to remember, especially if investigators ask leading questions or push for information that was never encoded or is no longer retrievable.

The following section of the SART Toolkit, Understanding the Science of Stress, Trauma, and Memory, gives SARTs more detail on memory science and its implications.

**Understanding the Science of Stress, Trauma, and Memory**

Stress and trauma can both enhance or impair the initial encoding (i.e., information getting into short-term memory during the event) and longer-term storage of some aspects of a
sexual assault in memory. The same “stress chemicals” that the defense circuitry releases to impair the prefrontal cortex (so habits and reflexes can control behavior) can alter how different aspects and phases of the assault are encoded and stored into memory - or not. [27] During a sexual assault, the brain encodes and stores some information, such as what may be necessary to predict and therefore avoid future attacks by perpetrators, but not other information.

Stress and trauma can enhance the encoding and storage of some aspects of a sexual assault. This has important implications for investigations because victims often have quite full, vivid, and accurate memories for the initial phase of the sexual assault, right before and after the defense circuitry took over and the stress and fear kicked in. Stress and trauma can “burn in” things experienced right before and after the assault was first detected, or aspects of the experience that were particularly frightening, upsetting, or otherwise emotionally significant. [28]

Stress and trauma can impair the encoding and storage of other aspects of the sexual assault. This includes parts of the experience that received little attention or emotional significance at the time, and aspects that require greater processing, such as the order of events. Such impairment tends to happen especially after the hippocampus leaves the “super-encoding phase” that kicked in when the attack was first detected (also when the freeze response happens). [29] When “impairments” interfere with forming memories of a sexual assault, they are part of proper and generally adaptive brain functioning. [30]

SART members must have realistic expectations of victims’ memories — expectations rooted in knowledge of how the brain responds to attack, stress, and fear. At the same time, always keep in mind that every victim and every assault is unique and, although unusual, some victims report vivid and relatively complete memories of what happened throughout an assault.

Service providers need to understand that alcohol and drugs, like stress and trauma, can impair memory for some aspects of an assault experience but not others. Moderate levels of alcohol or drug intoxication can impair encoding and storage of complexities like the time sequence but not impair the recording of what the victim’s brain focused on or what was most emotionally significant. [31]

It is critical not to assume that intoxication resulting in some memory impairment renders all of a victim’s memories unreliable. Particular details of the assault experience — for example, aspects of the experience that were particularly disturbing or a main focus of
attention, also known as “central details” – may be very well encoded and stored by moderately intoxicated victims. [32] That is usually not true of peripheral details, which are those that had little or no emotional significance during the assault or got little or no attention.

Even in states of severe intoxication, which leave the victim with minimal memories, the most disturbing or distressing aspect of the assault (including dashed hopes of being rescued by a bystander) can sometimes get enough of an additional “boost” from stress chemicals released by the defense circuitry [33] to be recorded vividly and accurately into memory.

For all these reasons, memories of trauma can be fragmentary, and it can be difficult for victims to recall details of a sexual assault in a complete or linear way. Victims or witnesses may recall some specific sensory details from particular aspects of the assault – sights, sounds, smells, tastes, touch – but little or nothing about other aspects. For example, a victim may remember the colors of the perpetrator’s tattoo but not their shirt; or a victim may not be able to remember how long the assault lasted or the order in which some things happened. Those are normal limitations of memory caused by stress, trauma, and substance intoxication.

Victims may take hours or days to successfully recall memories of sexual assault. A major reason is that stress impairs retrieval of memories for events. [34] A victim interviewed shortly after an assault, or while still very stressed or traumatized, will not be able to retrieve everything that has been encoded into her or his brain. Critically, if a victim is interviewed in a stressful way (e.g., without compassion, with interruptions of their narrative, with expressions of doubt about what they are reporting), they will not be able to recall potentially crucial information that is stored in the brain. Read the Trauma-Informed Response section of the SART Toolkit for more information.

SART members interviewing victims should also consider the beneficial effects of sleep on memory retrieval. Once parts of an assault have been encoded into memory, those “pieces of memory” will begin to fade or decay, or at least become harder for people to recall. This is because additional brain processes are required to “consolidate” or preserve their storage so they can be recalled later. [35] Researchers have found that such consolidation partly depends on sleep, [36] and critically, that such sleep-related consolidation only applies to emotionally significant parts of the experience. [37] These emotionally significant events, or central details, could be anything a victim focused on during the assault. [38] This means that anything experienced as a peripheral detail, [39] or emotionally neutral or insignificant
during the assault, will not benefit from consolidation during sleep and, all other things being equal (e.g., stress), those peripheral details will keep getting harder to recall.

Multiple interviews and open-ended questions support more complete retrieval. The best way to store and preserve pieces of memory that would otherwise become less and less accessible for retrieval is to retrieve them into awareness. [40] Each time memory pieces are retrieved — for example, in response to an open-ended question from an investigator — they are literally re-encoded into the brain (and potentially re-consolidated). This makes these memories more likely to be available for recall later. [41] A recent study suggests that prior retrieval can even protect peripheral details and originally emotionally insignificant information from decaying and becoming less accessible to retrieval. [42]

Everyone on your SART should be able to distinguish between central and peripheral details. It is important that SARTs build on best practice regardless of what interview method is being used in your SART’s jurisdiction, if your SART is making a change, or if your SART is engaged in a project to evaluate different interview methods for victims of sexual assault.