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Animal Defensive Reactions as a Model for Trauma-Induced Dissociative Reactions

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Patients with complex dissociative disorders remain in alternating psychophysiological states which are discrete, discontinuous, and resistant against integrative tendencies. In this contribution, a parallel is drawn between animal defensive and recuperative states that are evoked in the face of severe threat and the characteristic responses of dissociative disorder patients as displayed in major dissociative states. Empirical data and clinical observations seem to be supportive of the idea that there are similarities between freezing, concomitant development of analgesia and anesthesia, and acute pain in threatened animals and severely traumatized human beings.

KEY WORDS: dissociative states; animal defensive states; dissociation theory.

Patients with dissociative disorders, especially those with dissociative identity disorder (DID; American Psychiatric Association [APA], 1994), or dissociative disorder not otherwise specified (DDNOS; APA, 1994; Ross et al., 1992), show far-reaching and sudden alterations of behavior, affect, sensation, perception, and knowledge. According to Putnam (1988), these alterations indicate that these patients have developed "highly discrete states of consciousness organized around a prevailing affect, sense of self (including body image), with a limited repertoire of behaviors and a set of state dependent memories."

Following Wolff (1987), Putnam (1988, 1989) postulated that any human being remains in discontinuous, self-organizing, and self-stabilizing states

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of behavior, physiology, and consciousness. These states appear to be the fundamental unit of organization of consciousness, and are detectable from the first moments following birth in particular. In this view, switches between states are manifest by nonlinear changes in a number of variables, including access to memory, attention and cognition, regulatory physiology, and sense of self. As a result of a normal developmental task, the transitions across states of consciousness are smoothed out with maturation. The infant/child learns to achieve homeostasis in that it learns to modulate state, and it learns to recover from disruptions of state. These achievements presuppose a connectivity between states. In the course of maturation these various states, state-dependent experiences and memories will, thus, become preponderately associated and integrated with one another. They jointly will constitute the relative unity of consciousness, memory, and identity which most people are familiar with, and which characterizes their personality. Traumatization may interfere with these integrative processes (Janet, 1909; van der Kolk & van der Hart, 1989). Consistent with this view, dissociative patients as a rule report chronic sexual, physical, and psychological abuse. Further, there is evidence that dissociation of psychophysiological states of consciousness and behavior is a function of severity, duration, repetition of traumatization, and age at its onset, as Janet (1909; van der Kolk & van der Hart, 1989) already observed, and as contemporary researchers have confirmed (Boon & Draijer, 1993; Hornstein & Putnam, 1992; Ross et al., 1991).

Putnam (1988) did not explain what determines these diverging but nonetheless characteristic behavioral, physiological, and psychological aspects of various dissociative states. In fact, he remarked that ". . . very little is known about the alter personalities and what they truly present" (Putnam, 1993, p. 83). Since there seem to be striking similarities between the animal and human response to major threat, in the current article, the typical reactions of dissociative patients to perceived threat are compared to animal defensive and recuperative states. We will first discuss that animal defensive and recuperative reactions constitute a complex system consisting of various nonlinear substates which involve radically different behavioral and physiological reactions adapted to meet variable stages of predatory threat. Next, we will argue that these animal substates can serve as a model for some dissociative responses, and possibly even for some characteristic dissociative states of DID and DDNOS patients.

random responses. Their behavior *system* approach, however, views an organism as a set of organized and interrelated regulatory systems that precede, support, and constrain learning. Consistent with this view, animals do not respond to aversive, threatening stimuli with single responses, but with qualitatively different behavioral and physiological states that are tuned to optimalize survival chances in successive stages of imminence (Bolles, 1970; Bolles & Fanselow, 1980; Fanselow & Lester, 1988). These states are mutually inhibitive, and there is evidence suggesting that the various defensive subsystems (e.g., affiliative behaviors, freezing, aggression) are mediated by different neurochemical systems (Kalin & Shelton, 1989). Imminence varies in terms of space (physical distance between prey and predator), and time (frequency of previous predatory exposure in a particular location). Different stages of imminence evoke abrupt and specific shifts from one behavioral and physiological state to another, and include *pre-encounter, post-encounter, and circa-strike defensive subsystems,* and *recuperation*. These defensive and recuperative behaviors typically are rather primitive and inflexible, less subject to reinforcement than once had been supposed (Bolles, 1970), and highly subject to Pavlovian learning principles (Bolles & Fanselow, 1980).

Pre-encounter Defense

If an animal is not at risk of predation, its behaviors will be organized into the preferred activity patterns (Fanselow & Lester, 1988). Placing an animal at risk during foraging and consumption, these behavioral patterns are modified to reduce this risk (Fanselow & Lester, 1988; Helmstetter & Fanselow, 1993). Most nonaversively motivated behaviors are interrupted, and appetitively motivated behavior is *reorganized*. It appears that the animal's meal pattern varies with the risk of predation. Meal frequency decreases as risk increases, but compensatory increase in meal size defends total daily intake and body weight.

Post-encounter Defensive Behavior: Flight, Freeze, and Fight

When a predator has been spotted, flight is a proper response provided there is a good chance of successful escape. Nevertheless, and maybe contrary to expectation, freezing (behavioral immobility) is the dominant post-encounter response pattern, at least in some species. Freezing does not depend on the (un)availability of physical escape from threat, since it also occurs in the face of a potential escape route. It increases survival chances, even when physical contact has been made, probably because: (1) predators detect moving prey more easily, but have difficulty with noticing immobile objects, (2) the attention of predators may shift to other moving or noisy stimuli, and, (3) movement cues are critical releasing stimuli for predatory behavior, and freezing eliminates these cues (Suarez & Gallop, 1981). Species varying from fish to lions are subject to freezing, which seems related to "animal hypnosis" (cf. Krystal, 1988) or "tonic immobility" (Moore & Amstey, 1962).

Freezing does not merely concern a single response (inhibition of movement), but represents an integrated, functional behavioral and physiological pattern. For example, freezing does not occur arbitrarily, since, for instance, rats in nature as well as in experimental contexts freeze next to walls, usually in corners, and if available, in darker areas or places less strongly associated with threat.

Circa-strike Defense: Analgesia, Emotional Numbing, and the Startle Response

When the animal is about to be attacked, freezing tends to be combined with analgesia, which is functional in that perception of pain (nociception) would divert the attention of the prey from defensive concerns (Bolles & Fanselow, 1980). Analgesia can be evoked by innately recognized predators, odors of stressed conspecifics, learned danger signals, pinches directed to the scruff of the neck, and dorsal constraint (Siegfried, Frischknecht, & Nunez DeSouza, 1990). The response can be mediated by endogenous opioids (Fanselow & Lester, 1988; Krystal et al., 1989; Siegfried et al., 1990; van der Kolk & Greenberg, 1987), as well as non-opioid mechanisms (Siegfried et al., 1990). There is evidence that endogenous opioids are also involved in stress-induced and CS-induced catalepsy or immobility (Amir, Brown, Amit, & Ornstein, 1981; Fanselow, 1986; Teskey, Kavaliers, & Hirst, 1984), reduction of panic and fear (Siegfried et al., 1990; van der Kolk, 1994), suppression and delay of emotional and panic escape behavior, and inhibition of the production of sounds (e.g., cries for help; Kalin, 1993). These effects inhibit reactions which would compromise optimal defense in this stage of imminence. For example, grooming and licking wounds would attract attention, and would elicit further attack (Siegfried et al., 1990).

When a predator rapidly approaches and comes close, the prey again dramatically changes its behavior (Fanselow & Lester, 1988) in that it suddenly displays an explosive escape response, i.e., the potentiated startle response (Hirsch & Bolles, 1980), as well as aggressive behavior (Kalin, 1993). If these responses do not eliminate contact, immobility may return, reducing the likelihood of continued attack (Fanselow & Lester, 1988). Under certain conditions, CS will potentiate the startle response, as well as aggressive behavior (Pynoos, Ritzmann, Steinberg, Goenjian, & Prisecaru, 1996). These effects increased with repeated attack.

Post-strike Behavior: Pain and Recuperation

The recuperative stage may be considered, in part, as a response to nociceptive stimulation arising from injury and tissue damage (Bolles & Fanselow, 1980; Fanselow & Sigmundi, 1982; Siegfried et al., 1990). On the termination of imminence, pain perception returns and instigates recuperative behavior (Bolles & Fanselow, 1980), including behaviors directed at injuries, grooming behavior, and resting behavior serving to promote healing. Other kinds of motivation seem, meanwhile, to be inhibited. Upon recovery, there is a return to preferred nonaversively motivated behaviors.

While stimuli predicting aversive events come to elicit analgesia, the presentation of a safety signal (i.e., a stimulus paired backward with UCS), produced an abrupt change in pain sensitivity, essentially "switching off" conditioned analgesia (Wiertelak, Watkins, & Maier, 1992). It thus is suggested that, just as (conditioned) signals for danger elicit analgesia, (conditioned) signals for safety inhibit (conditioned) analgesia. Nociception, subsequently, evokes recuperative behavior.

Some data suggest that animal pain can be reproduced in absence of external pain induction. It has been found that a formalin-induced nociceptive message induced an enduring trace in the animal central nervous system (Cadet, Aigouy, & Woda, 1993), and long-lasting and site-specific sensitization of animal defensive reflexes following shock and injury have been related to hyperalgesia (Walters, 1987). Conditioned animal hyperalgesia has been observed, but seems rare.

Inescapable Shock

While animal defense consists of *unconditional response-sets* elicited by specific natural threat stimuli, these reactions can also experimentally be induced by electrical shocks. As numerous animal studies have shown, experimental traumatization, operationalized as inescapable shock (IS), evokes defensive reactions which in nature appear in the post-encounter and circa-strike stage (see Fanselow & Lester, 1988). A mild shock may, for example, evoke freezing, whereas a more severe shock results in a sudden burst of activity. Using different rates of electrical shock density, Fanselow and Lester (1988) were even able to model all natural stages of imminence. Low density shock produced pre-encounter defense, medium density shock post-encounter defense, and high density shock circa-strike defense.

Animals that initially learned how to physically escape from shock, unconditionally react with an alarm or startle response (an explosive motor burst) when such escape is prevented. IS is secondarily followed by a state of helplessness, freezing, and analgesia. Remarkably, new possibilities of escape do not instigate physical escape: most animals remain frozen, and passively endure continued shock (Garber & Seligman, 1980; Seligman, 1975). IS thus seems to induce deficits in learning and memory. This passive way of self-defense apparently blocks later acquisition or application of more active defensive strategies, as it is also elicited through exposure to stimuli that are associated with IS. Just one or very few learning trials, in which particular stimuli are saliently associated with the ones that evoke IS-responses naturally, can be sufficient in creating conditioned alarm responses, freezing, analgesia, and increased defecation (Cassens, Kuruc, Roffman, Orsuluk, & Schildkraut, 1981; Desiderato & Newman, 1971; Fanselow, 1980; Fanselow & Lester, 1988). For example, presentation of such conditioned stimuli (CS, i.e., previously neutral stimuli that have come to be associated with an unconditioned stimulus [UCS] in that they signal or refer to an aversive stimulus) made rats stop consuming food and drinks, and evoked freezing (Bouton & Bolles, 1980). The acquired associations between an extreme aversive stimulus (UCS) and other stimuli are extraordinarily resistant to change. Further, after threat exposure, the animals tend to react in exaggerated ways to previously tolerated stressors. This effect seems to indicate a sensitization effect (i.e., response increment without further exposure to threat).

Freezing is controlled by antecedent, not consequent, aversive stimuli. For example, punishment of freezing through shock *increases* this kind of behavior (Fanselow & Lester, 1988). As rats do in nature (cf. p. 246), in experimental contexts they also freeze in darker areas or other places less strongly associated with threat, such as next to walls, usually in corners.

There is an abundance of animal research showing that intensity, duration, frequency, uncontrollability, and unpredictability of exposure to aversive stimuli significantly affect IS-outcome (e.g., Anisman, de Catanzaro, & Remington, 1978; Weiss, Stone, & Harrell, 1970; see Foa, Steketee, & Rothbaum, 1989; Mineka & Kihlstrom 1978). According to van der Kolk (1987), the crucial traumatic ingredient concerns real as well as perceived lack of control, since the behavioral and biochemical sequelae of inescapable shock are the opposite of those of escapable shock.

Defense in Social Conflict Situations, and Pain

Studying nonaggressive mice intruding the territory of aggressive resident conspecifics, Siegfried et al. (1990) were able to largely confirm the assumptions that inhibited pain and movement serve defensive functions, that learned danger signals activate defensive behavior, including analgesia, and that nociception elicits recuperative behavior. As Siegfried et al., and others (cited in Siegfried et al., 1990) found, pain may, however, also precede and elicit analgesia, as well as defensive behavior, and tolerance of analgesia may develop upon continued traumatization. Animal pain can, thus, be evoked in various stages of imminence.

Early Availability and Rapid Maturation of Defensive Responses in Animals

A defensive system which would depend on long-term maturation and extensive trial-and-error learning does not make evolutionary sense. It thus comes as no surprise that this system is available early in life. For example, rats innately, automatically, and rapidly freeze to predators such as cats, snakes, canines, and humans (Fanselow & Lester, 1988). Yet, the effective organization of defense demands a degree of maturation of the brain (cf. Jacobs & Nadel, 1985; LeDoux, 1989). Infant rhesus monkeys as young as 0 to 2 weeks displayed different defensive behaviors, but, not knowing how to coordinate these tendencies, at this age they did not selectively respond to different stages of imminence (Kalin, Shelton, & Takahashi, 1991). By 9 to 12 weeks of age, these infants modulated their type of defensive response to the parameters of the threat when exposed to threat for the *first time.* At this age, rhesus monkeys undergo cognitive and behavioral changes associated with brain development similar to those in human infants 7 to 12 months old, which is the time when human infants engage in complex emotional and behavioral responses. These effects seem to be independent of social experience (Sackett, 1966). Apart from maturation, learning is to some extent involved As Garcia and Garcia *y* Robertson (1984) put it: "All organisms inherently possess the basic behavioral patterns that enable them to survive in their niches, but learning provides the fine tuning necessary for successful adaptation" (p. 197).

Symptoms of Traumatized Individuals and Those with Dissociative Disorders as Related to Animal Defensive and Recuperative Response-sets

Some types of human trauma may be compared to predator attack, IS, and animal social conflict. For example, phenomenologically, sexual and physical abuse resemble IS, especially when occuring to children and involving relatives as perpetrators. Such highly aversive, burdening, and painful stimulation is inescapable in that perpetrators often force passive subjugation to sexual abuse (Albach, 1993; Draijer, 1990). It also reflects a loss of control and familiarity.

Since the beginning of this century, several authors have observed a striking analogy between certain animal defensive responses and aspects of trauma-induced psychopathology in humans (Kraepelin, 1913; Kretschmer, 1960; Krystal, 1988; Ludwig, 1983; Rivers, 1920). In these analogies the rapid reflex-like character and evolutionary value of these reactions is emphasized. While Rivers (1920) stressed the *survival value* of freezing, and the concomitant reduction of fear and pain, other authors have described this defensive response pattern as a *surrender* reaction in the face of unavoidable and overwhelming danger, providing a means of painless death (for a review Krystal, 1988). Interestingly, the animal defense model as proposed by Fanselow and Lester (1988) involves two stages of imminence evoking these reactions. At the encounter stage, freezing/analgesia is thought to serve survival. Once a strike has occurred, and aggressive or flight responses prove ineffective, there is a return to freezing. Freezing/analgesia in this stage may still have survival value (Fanselow & Lester, 1988), but at the same time it may be "a merciful provision by our benevolent Creator for lessening the pain of death" (Livingstone, 1872, p. 15, cited in Greyson, 1993).

More recently, the many apparent behavioral and biological similarities between the human response to trauma and the animal response to inescapable shock (IS) led van der Kolk, Greenberg, Boyd, and Krystal (1985) to propose that the animal model of IS may serve as an appropriate biological model for posttraumatic stress disorder (PTSD) in humans. PTSD involves physiological and behavioral hyperreactivity (positive symptoms: hyperarousal, and intrusive reliving of traumatic events in flash-backs, nightmares), alongside restriction-phenomena (negative symptoms: emotional constriction, social isolation, anhedonia, a sense of estrangement). According to van der Kolk et al. (van der Kolk & Greenberg, 1987; van der Kolk, 1994), both reaction-patterns are due to chronic alterations in the central neurotransmitter systems.

Considering certain similarities between patients with PTSD and with dissociative disorders (Bremner, Southwick, Johnson, Yehuda, & Charney, 1993; Warshaw et al., 1993), we assume that animal defensive state dependent responses to predators, IS, and aggressive conspecifics are also of relevance with respect to a better understanding of trauma-induced dissociation. More specifically, we suspect that they may shed more light on the roots of characteristic dissociative states, and the typical responses displayed in these discrete states. If there is a phylogenetic parallel between animal defensive and recuperative states on the one hand, and dissociative responses and dissociative states on the other hand, one would expect that dominant pre-encounter, post-encounter, circa-strike, and recuperative animal responses will also appear in traumatized dissociative patients.

The following discussion is not exhaustive. We will focus on freezing, analgesia/anesthesia, and pain, and show that most of these symptoms seem to characterize traumatized subjects, and dissociative disorders patients in particular. We do not consider, for example, disturbed eating patterns, aggressive reactions, and flight.

Freezing

Albach (1993) and Draijer (1990) found that only a minority of adult females reporting childhood sexual and physical abuse actively resisted the perpetrator (also: Gebhard, Gagnon, Pomeroy, & Christenson, 1965). because such defense was perceived as useless, or as eliciting further attack. Passive defense (dissociation and fantasy) increased with severity of abuse, and initial resistance decreased with sustained abuse. Most abused women recalled that they were forced to go along with the abuse by way of psychological and physical aggression, or life threats. Flight responses were shown by about half of these women, but were restricted to hiding in dark corners or under blankets. They tended to freeze at those places. Albach (1993) further found that bodily stiffening was reported by as many as 87%. Fainting and paralysis may represent freezing-related responses, and these symptoms occurred in about a quarter of the cases. In other studies, it was found that a substantial number of women reported freezing and paralysis before and during rape (Brickman & Briere, 1989; Burgess & Holmstrom, 1976; Galliano, Noble, Travis, & Puechl, 1993).

We are not aware of systematic studies of freezing among dissociative patients, although Smit and Takke (1994) found that dissociative patients, in contrast with other psychiatric patients, predominantly, if not exclusively, used passive coping styles. Clinical observation (Putnam, 1989) suggests that during traumatized child states, which are frequent in DID (Boon & Draijer, 1993; Putnam, Guroff, Silberman, Barban, & Post, 1986; Ross, Norton, & Wozney, 1989), individuals tend to hide in dark places, freeze there, and prefer to physically disappear when they feel threatened. Adopting a fetal position, they seem to be unresponsive to external stimuli. More generally, upon feeling threatened, adult DID-patients often switch into a trance-like state, freeze, become analgesic, and afterwards report out-of-body experiences, or dissociative amnesia. It is also clinically found that consequent stimuli like punishment do not decrease freezing. On the contrary, as happens with shocked animals, defensive responses then will *in-*

crease. The behaviors are automatically evoked by environmentally as well as internally presented CS (Janet, 1928; Nijenhuis, 1994, 1995; van der Hart, Boon, Friedman, & Mierop, 1992). It thus seems that, as with animals, human freezing is controlled by antecedent aversive UCS and CS.

Analgesia, Anesthesia, and Emotional Numbing

A large majority of Albach's (1993) subjects who reported childhood sexual abuse experienced analgesia and kinesthetic anesthesia (insensitivity for touch). In fact, analgesia was the most commonly reported "hysterical" symptom. Most female and male DDNOS and DID patients also present analgesic dissociative states (Boon & Draijer, 1993; Loewenstein & Putnam, 1990). Consistent with a Pavlovian view on symptom formation, analgesia and other traumatic responses seem to be reactivated by salient trauma-associated stimuli, even after a delay of 2 decades (van der Kolk, Greenberg, Orr, & Pitman, 1989; Pitman, van der Kolk, Orr, & Greenberg, 1990). With PTSD patients, this analgesia is reversible by naloxone (Pitman et al., 1990), as is often the case with animals (Siegfried et al., 1990). Analgesia and anesthesia frequently go along with emotional numbing, trance-like states, depersonalization, and derealization (Albach, 1993). Automutilation tends to be accompanied by analgesia. In a later stage, nociception returns, which elicits recuperative behavior.

Further exploration is needed to determine whether analgesia, anesthesia, and psychological numbing as dissociative reactions of dissociative patients are exclusively functions of endogenous opioid and non-opioid neurochemical responses to a traumatic stressor (van der Kolk et al., 1989). The symptoms involved may, for example, very rapidly change with state, and may be restricted to localized bodily areas unrelated to neurophysiological systems. From a psychological point of view, these effects could also relate to threat-induced restriction of attention (Janet, 1893), which also occurs in threatened prey.

Pain

As a rule, studies on animal trauma-induced pain pertain to acute pain, and chronic animal pain seems to be rare. Traumatized and dissociative human subjects, however, often report chronic, as well as acute pain (e.g., Draijer, 1990; Ross, Heber, Norton, & Anderson, 1989; Saxe et al., 1994; Toomey, Seville, Mann, Abashian, & Grant, 1995; Walker, Katon, Neraas, Jemelka, & Massoth, 1992), which may be state-dependent (McFadden & Woitalla, 1993). The observed difference between species is puzzling.

Early Availability and Maturation of Human Defense

As is likely to be the case with animals, human defensive behaviors seem to be available very early. For example, human infants can display a sudden, catatonoid state when exposed to threat (see Krystal, 1988). Yet, as is the case with animals, maturational processes have a role, because the quality of human infant responses to threatening situations changes with age (Bronson, 1972). For instance, from between 7 and 10 months, infants inhibit their ongoing behavior, or withdraw when exposed to novel or threatening situations and unfamiliar people (Campos, Barrett, Lamb, Goldsmith, & Stenberg 1983; Rothbart, 1988), which changes are likely a consequence of perceptual, sensorimotor, and cognitive maturation (Kagan, 1983). The behavioral tendencies may be stable over time. For example, children who display extremely inhibited responses when they are 2 years of age are likely to be pathologically fearful later in life (Biederman et al., 1990). As the appropriate manipulation of experiences early in life can generate stable and relatively permanent complex individual differences, and modify emotional reactivity (Whimbey & Denenberg, 1966), traumatization at this phase of life may induce chronic traumatic responses.

If this line of reasoning is valid, traumatized children with dissociative disorders should have symptoms which also characterize adult dissociative disorder patients. The available evidence indeed suggests that children with DID display features largely identical to these of adults (Fagan & McMahon, 1984; Hornstein, 1993; Hornstein & Putnam, 1992; Kluft, 1984; Reagor, Kasten, & Morelli, 1992; Tyson, 1992). These include negative symptoms (e.g., amnesia, trance states, being unresponsive to external stimuli, anesthesia, analgesia, paralysis, and loss of feeling), as well as positive symptoms (e.g., hypervigilance, startle responses, and rapid transitions of state). The appearance of spontaneous trance-like states, in which the children do not seem to pay attention to their surroundings, may be the most prevalent dissociative symptom of children with DID (Putnam & Trickett, 1993). Furthermore, very young sexually and physically traumatized children have positive symptoms, such as pain symptoms related to the specifics of the abuse (e.g., anal pain, abdominal pain), fears of trauma-related stimuli, display of aggressive and fearful regressive behavior, and dramatic increases in affiliative behavior (Burgess, Hartman, & Baker, 1995). These children also have negative symptoms, such as trance-like states, staring into space, being highly inattentive and detached from others, and refusal to eat, or to feed oneself.

The stress responses exhibited by infants are the product of an immature brain processing threat stimuli and producing infant appropriate responses, while the adult who exhibits infantile responses has a mature brain that, barring stress-related abnormalities in brain development, is capable of exhibiting adult reponse patterns. However, there is evidence that the adult brain may regress to an infantile state when it is confronted with severe stress (Jacobs & Nadel, 1985; LeDoux, 1996). As LeDoux (1996) argues, the amygdala is essentially involved in very rapidly and automatically instigated physiological and behavioral responses to major threat, as well as the classical conditioning of these threat responses. This conditioning yields probably indelible associations between unconditioned and conditioned stimuli. Extreme stress does not interfere with, and may even amplify, memory processes mediated by the amygdala (Corodimas, LeDoux, Gold, & Schulkin, 1994), but it does hamper hippocampal-neocortical information processing which should inhibit or regulate emotional reactions and memories. Chronic release of stress hormones may even damage the hippocampus. This stress-induced condition resembles the infantile state, which is characterized by functional amygdala and a relatively immature hippocampal-neocortical system. Extreme stress may therefore evoke defensive reactions in adults which are also evoked in young children.

Summary and Discussion

While pathological dissociation has been related to state-dependent learning and memory (Janet, 1889; Putnam, 1988, 1992), it is presently unknown what factors explain the various characteristics of a yet limited range of distinct dissociative states. In this article, a phylogenetic parallel is proposed between characteristic dissociative responses and behavioral and physiological animal defensive and recuperative states. This model obviously is speculative in nature, but it shows promise since some empirical data and clinical observations seem to support its validity, and it may be of heuristic value.

The basic idea is that different stages of imminence may serve as UCS to evoke particular unconditioned responses, which prey and human beings seem to share as a consequence of phylogenetic survival value, and which are available at an early age. The various unconditioned responses are thought to be organized in subsystems of defense and recuperation jointly constituting a complex system (Timberlake & Lucas, 1989). Trauma is likely to evoke substate-bound reaction patterns, providing optimal adaptation to particular stages of imminence. Less adaptive reaction patterns will concomitantly be inhibited. In some cases, the expressions of defensive and recuperative substates may mark dissociative states, or perhaps even subtypes of dissociative states, as apparent in complex dissociative disorders. As traumatization reflects a process of classical conditioning, previously neutral stimuli which are saliently associated with innately aversive stimuli may acquire the capacity to raise an expectancy of threat (Bolles & Fanselow, 1980). Consequently, these CS may posttraumatically reactivate substates of defense and recuperation. More severe, and more frequent, UCS exposure would promote the strength and chronicity of conditioned dissociative reactions.

Testable hypotheses can be derived from the model, and a few of them can be indicated: (1) Dissociative disorder patients would predominantly display quite particular somatoform and psychological dissociative symptoms relating to defense and recuperation, including analgesia, anesthesia, motor inhibitions, and restrictions of perceptual fields. While the research to date suggests that dissociative disorder patients often have these symptoms, they tend to have many other symptoms as well. The present model predicts that the indicated symptoms will characterize these patients best, even when controlling for general psychoneuroticism. (2) Upon exposure to conditioned threat stimuli—including external, as well as internal stimuli (Nijenhuis, 1995)—defensive states, instead of isolated conditioned responses, would tend to be reactivated. That is, CS associated with threat which once appeared in a particular stage of imminence would reactivate the related dissociative reaction patterns, or dissociative substates. Clinical observation does indeed suggest that, for example, a freezing state is reactivated by CS associated with the post-encounter stage, an aggressive state by CS relating to the circa-strike stage of imminence, and recuperative states, after a delay, by (self-inflicted) injury. We are not aware of systematic research in this area. (3) Finally, taking into consideration the evolutionary importance of *rapid* responding to major threat, it would seem odd if dissociative defense were strongly dependent upon the relatively slow cognitive (hippocampal-neocortical) information processing system (LeDoux, 1989). The present model postulates that dissociative defensive reactions are elicited almost instantaneously (LeDoux, 1989; see also, Bremner, Krystal, Southwick, & Charney, 1995), which, therefore, cannot be satisfactorily explained by time-consuming processes such as imagery and autohypnosis (cf. Butler, Duran, Jasiukaitis, Koopman, & Spiegel, 1996). However, hypnotic or hypnotic-like processes may be involved in the *secondary* development of personality-like characteristics of dissociative (identity) states (Nijenhuis, 1995). Such characteristics and dissociative state-dependent memory structures may evolve and be reinforced as a result of retraumatization and CS-evoked reactivations of the relevant states.

According to Fanselow and Lester (1988), (conditioned) fear induces analgesia, and acute animal pain is restricted to the recuperation phase. The finding that (conditioned) safety signals produce acute anti-analgesic effects in animals is supportive of this view. It is, therefore, worthwhile studying whether, and to what extent, acute and chronic analgesia and pain in dissociative disorders depend on (conditioned) danger and safety signals. The role of animal pain may, however, be more complex than Fanselow and Lester have suggested: Acute animal pain may precede and elicit analgesia, not all trauma-related CS may, apart from defensive behavior, evoke analgesia, and repeated social attack may imply return of nociception (Siegfried et al., 1990). The evidence to date suggests that conditioned animal hyperalgesia is rare, but the subject deserves further attention. While there are parallels between acute attack-induced and short-term delayed pain in animals and humans, it is as of yet uncertain whether this similarity can be extended to chronic pain.

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