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Behavioral and Physiological Effects of Trauma on Psittacine Birds

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Abstract

Neuroethological studies have documented how sociality— the broader system of attachment, associations, knowledge, and behaviour of a given species-- plays an important role in shaping the brain's self-regulatory structure that governs behaviour and stress reactivity. Disruptions to normal sociality patterns by chronic stress (e.g., parental deprivation or inadequate care) and shock trauma (e.g., abuse, capture) are associated with long-term psychobiological dysregulation. Here, we discuss the concept of psychophysiological trauma developed from extant mammalian research as a way to deepen our understanding about parrot behaviour, health, conservation, and care.

Introduction

Bird behaviour and its causes are integral to avian care. Changes in behaviour can often presage the first sign of physiological distress. Behaviour issues are among the most common reasons that prompt owners to bring their bird to the veterinarian or, in many cases, relinquish the animal. Understanding what influences and causes behaviour is key to parrot health and well-being. Practitioners of avian medicine often have the opportunity to counsel clients who are keenly interested in their parrot's behaviours and are now, with an increasingly large body of work surrounding the brain and how its development relates to behaviour, provided with another educational avenue. As findings relevant to thinking and behaviour are popularised, avian medical professionals find themselves in the midst of lively examination. This paper attempts to distil current thinking with applications pertinent to captive psittacines and their caregivers highlighted.

One important factor influencing how an individual acts is social relationships. The effects of social bonding and attachment are particularly important in early development when there are major periods of brain growth and neurophysiological structuring. Numerous studies have shown that disruptions to early infant-parent relationships, physical and psychological deprivation, and experiences of trauma can seriously impair neuroendocrinal patterning that may persist and affect an individual throughout their life. Even later, during adulthood, traumatic events or sustained deprivation can create enduring dysfunction and distress.

The majority of research on the relationships between neurophysiological development, social processes, and behaviour derive from studies of mammals. However, it is now widely accepted by the biomedical community that the same structural genes organize the body plan and fundamental structures and metabolic mechanisms are shared across vertebrates. Further, social attachment mechanisms that play such an important role in shaping early behaviour patterns are ubiquitous among diverse species that include mammals and many avians, particularly altricial species. In combination, these commonalities allow comparisons across species historically regarded as mutually distinct.

Like many mammals characterized by a "social brain", members of Psittaciformes (parrots, lories, cockatoos, parakeets) are highly social. These species spend much of their formative years and lifetime gathered in flocks ranging from the size of small groups to thousands in number. They are also species renown for a plethora of observable behaviors and complex language. An increasing number of parrots experience major disruptions relative to their historical patterns of sociality. In the wild, habitat destruction and capture, and in captivity, neglect, isolation, premature weaning to poor rearing under artificial conditions, are all elements that disrupt normal parrot social life.

We review mammalian research on trauma and social attachment that, in light of recent findings on avian-mammal brain homologies (1), suggests a shared relevance for birds. Bringing the lessons of mammalian research to psittacines has several benefits. First, it provides a common conceptual framework and terminology among diverse knowledge groups—research scientists, clinical and research veterinarians, parrot owners, behaviour consultants, and conservation professional—to describe parrot psychophysiological states and behaviour.

Traditionally, subjective attributes (e.g., emotions) have been excluded from animal sciences which have dealt nearly exclusively with objective (e.g., biophysical) observations. Animal emotions have been denied or dismissed as "anthropomorphism" even though such observations have been a main source of information concerning parrot welfare as provided by their owners. Second, this existing research furthers greater appreciation of intra- (parrot-parrot) and interspecific (parrot-human) relationship affects on psittacine well-being and stress-reactivity. Understanding how impaired rearing and disruption affects neuroendocrinal development and behaviour are integral to creating supportive health care and positive companion parrot-human relationships. Third, it brings attention to the topic of wild psittacine sociality, a reality that has been given very little attention by research and conservation. These are all topics that contribute to issues and ethics of keeping and rearing captive birds which is becoming an increasingly controversial topic.

Comparing Parrots with Other Vertebrate Species

An extensive body of literature describing the relationship between stress and patterns of brain and behaviour has accumulated since the early part of the twentieth century (2,3). This literature derives from studies on a variety of species including humans, birds, rats, cats, nonhuman primates, and even invertebrates. Subsequently, while most of the research has been performed in service of understanding humans, there have been concomitant advances in understanding brain structure and function across species.

Human and animal cortico-limbic structures and mechanisms are highly conservative evolutionarily (4,5). Specific areas in the brain responsible for coordinating stress-response behavior, analysis of visual coding and processing, and auditory, somatosensory, and memory-sensory integration are shared from rodents, primates to humans. While there are species-specific differences, all mammals share the same generalized "emotional brain" that includes the prefrontal cortex, cingulate cortex, amygdala, insula, hypothalamus, brainstem and associated physiological (e.g., autonomic, cardiovascular, immunological, analytical), psychophysiological and behavioral traits (e.g., extinction learning, fear conditioning; attachment and social bonding, pain, aggression; anxiety, and facial recognition (3, 5, 6). Furthermore, cerebral lateralization of a variety of adaptive capacities has been documented in diverse vertebrates: fish, amphibians, reptiles, birds, and mammals.

In addition, evolution is now conceptualized neither as linear nor as progressive which means that structures and functions identified as recent developments are not necessarily more advanced than previous developments (7). Structures and organization of the brain change in a highly coordinated fashion as brains enlarge. Brain research has demonstrated that the principles of organization in the largest brains are quite predictable from the organization of the smallest. Vertebrates are considered to share a "core" psychophysiology for which species differences grow or lie upon like diverse patterns of painted veneer. However, even given observed differences, vertebrate brains are remarkably similar (8).

Structural patterns are echoed in behavioural patterns. In the past, science dismissed animal emotions and psychology, but today, properties once thought uniquely human—culture, cognition, language, emotion, personalities—one-by-one are found in species morphologically varied as fish, sheep, rats, crows, and perhaps even invertebrates. Not only can apes and birds design and use tools, but we are told that elephants get posttraumatic stress, fish suffer distress, and sheep can distinguish family members and emotions by facial expression. Magazines, journals, television programs and internet sites daily extol the latest scientific findings, many of which are read avidly by psittacine caregivers. Clearly, this long-held interest continues to gain momentum and may become increasingly valuable to avian medical professionals as we counsel caregivers on issues such as enrichment and well-being of companion birds.

Brain imaging has been particularly instrumental in reshaping views of human and non-human relationships, particularly for cognition, emotion and mental states previously thought indescribable except by the experiencer. Imaging technology has provided a window into previously un-concretized mental states in humans, which can then be very directly compared with life states, hormonal status, and the same type of brain activity in animals. The subjective has become objective, tractable, and species-general. When we extrapolate – or at least when our clients do -- that these findings and comparisons extend to parrots, we extend our vocabulary to join the chorus of current intelligence all aimed at making the lives of captive birds more enriched for animals and people.

It is generally agreed that as vertebrates, avian and mammal neurophysiology and neuroendocrine systems share many homologies: that is, they overlap in structural and functional similarity and correspondence, factors that have allowed bird studies to be strong contributors to behaviour ecology in general (9, 10, 11). There are obvious distinctions but models of homology are replacing models of analogy as the similarities between species are increasingly appreciated. Many of the perceived differences between mammalian and avian brains have now been demonstrated as out-moded traditions of nomenclature (1). Concerning avian brains, researchers have found that:

> Overall, the evidence indicates that there are pallial, striatal and pallidal domains in most or all vertebrates. Therefore, it is reasonable to propose that the telencephala of early fishes possessed all three domains, which were then inherited as a package by later vertebrates, and independently modified in them. (pp, 156; 1)

and conclude that:

> "On the basis of this new understanding of avian brain organization and its evolutionary relationships, we estimate that, as in mammals, the adult avian pallium comprises about 75% of the telencephalic volume… This realization of a relatively large and well developed avian pallium that processes information in a similar manner to mammalian sensory and motor cortices sets the stage for a re-evaluation of the cognitive abilities of birds" (pp. 156; 1)

Germane to the present discussion is that these findings infer that birds and mammals share common structures and functions underlying psychophysiology of trauma, stress, and, in cases of social species, attachments mechanisms. Therefore, lessons from mammalian research can be used as general principles to explore avian behaviour and experience. However, recognition of structure-function overlap among species does not mitigate the importance of difference, but it does help us understand more clearly the role and significance of specific adaptations and preferential development in each species through the comparative method.

Models of Stress and Trauma

Brain development and function are highly sensitive to surroundings and experience as well as to genetics. Interactions with the environment can either negatively or positively affect brain and behaviour development. If environmental change cannot be accommodated or a certain psychophysiological envelope is exceeded, strain results from the stress, and may negatively impact fitness and viability (12). Stress, defined generally, as "the non-specific response of the body to any demand," varies with each individual and circumstance.

The impact of stress is positive or negative predicated on the model of homeostasis and adaptation. Stress and its response are part of regulatory functions that maintain the organism in a given state relative to the ambient environment. From this model's perspective, the internal processes of an organism are in a constant dynamic but remain within a limit of variation, or a state of homeostasis. Homeostasis -- the idea there is a single optimal state to which the organism adjusts---is the capacity to respond to and compensate for some disturbance in the system.

Some regulatory processes are autonomic and take place at the scale of the cell or organ. For example, if body temperature drops below a certain level, biochemical processes occur that compensate for the external temperature to regulate internal temperature. More recently, homeostasis has been modified by the concept of allostasis (stability through change). Allostasis is a concept that recognizes thenumerous states toward which regulation is aimed, and these states occur depending on specific circumstances. Further, some of these states may lie outside the bounds of normal range, but it is argued that these physiological adaptations allow the organism to survive through change and revert to homeostatic conditions when the external stressor is gone or has abated. In contrast to homeostasis, allostasis maintains that the regulation is not to maintain constancy but to confer fitness through natural selection. The ability to adjust to multiple states through diverse cycles of both predictable and unpredictable change is considered a fundamental process to all organisms.

When internal regulation cannot be accomplished by autonomic processes, the organism uses another strategy called adaptation. Adaptation is the way in which an individual responds to or conforms to environmental change that is outside the range of autonomic homeostasis. Adaptation can entail structural, behavioural, or physiological changes. Natural selection and evolution are examples of how western science views processes of adaptation at longer time scales. Depending on the circumstances, past experience and capacity to adjust to pressures from the environment, an organism has greater or lesser success for adaptation. There is an impetus to adapt because signals from the environment are somehow exceeding a tolerance level.

In some cases, adaptation involves increasing this tolerance or habituating to the environment in some way. One good example of habituation is deer browsing only a few feet from a busy freeway. As any hiker experiences, most deer will be startled and flee when encountered in the woods. In the case of "freeway deer", they have become habituated to the noise and movement over time; the disturbance of cars, horns, and people has developed into a tolerance. The converse is referred to as sensitization, and it occurs is when an organism becomes less tolerant to a particular environmental signal. Sensitisation usually occurs when there is a signal that is associated with a negative outcome such as pain.

Since the work of Selye, stress research has made considerable conceptual changes. The simple model of homeostatic action and reaction has been replaced with models where there are sets of "complex interactive network[s] of relationships among the brain and body" (pp. 60; 19). In contrast to earlier purely biophysical, linear models, current models maintain that stress responses can be mediated psychologically and effects are highly non-linear. In lieu of conceptualizing behaviour dichotomously, deriving from either genes or environmental conditioning, nature and nurture are now understood as synergistic forces acting from inception through adulthood. Behaviour and the capacity to regulate stress responses are contingent on the interactions of heritage and experience. Robert Hinde writes that these relationships:

> can be understood only in terms of a continuing dialectic between an active and changing organism and an active and changing environment with cause and consequence closely interwoven.

When we posit various socially-based theories of epidemiology, such as those linked with stress-mediated health conditions and mortalities aetiology, we can now also include consideration of psychosocial, socio-political, and ecosocial concerns. Much of this conceptual development has been stimulated by work on trauma.

Traumatic stress is generally distinguished from other stress in that it is defined as a physically or emotionally inflicted injury perceived by an individual or a group to threaten their existence (13).Trauma can occur under diverse circumstances but generally falls into two categories: (1) shock trauma; (2) developmental trauma. Disruptions to socialization patterns (e.g., a breakdown of social structures and balanced attachment relationships) and processes (e.g., stable rearing conditions and experienced parents) or psychological and physical deprivation particularly in young developing individuals creates conditions of stress that may exceed the ability to adapt successfully. Such failures to develop stable patterns of stress reactivity and response can lead to affect regulation and other systemic behavioural disorders (14,15).

Trauma and Chronic Stress Effects on Mammalian Neuroethology

An infant's environment is dominated by one or more parents and guardians, depending on species. In the case of some species such as elephants or bobolinks (*Dolichonyx oryzivorus*), rearing is guided by a constellation of allomothers or alloparents, respectively. It has long been recognized that attachment to the mother is crucial in infant development, but the neurological role of socially-mediated processes has only recently been appreciated as an essential mechanism for facilitating maturation of the brain's self-regulation systems (3). The behaviour of a mother or primary caretaker(s) guides the infant's response to stress through neuroethological patterning and tissue-specific effects on gene expression. Together with the genome, the experience-dependent process of attachment shapes early maturation of neural mechanisms, brain structure, and behaviour (2).

Through attachment transactions, the infant's shifting arousal levels are regulated and stressful states of homeostatic imbalance repaired by the caretaker. Prefrontolimbic areas in the maturing right brain are centrally involved in attachment functions and regulating stress response patterns of the hypothalamic-pituitary-adrenal (HPA) axis common to both avians and mammals. Both the caretakers' own self–regulation capacities and the offspring's development reflect conditions of the greater environmental surround (i.e., ontogenetic niche). When, as in the case of captured birds or captive birds raised under inadequate socio-ecological conditions, long-lasting changes in neuroplasticity, behavior, and psychophysiology can occur (16, 17, 18, 19).

The loss of the ability to regulate affective state reactivity is considered the most far-reaching effect of early trauma and neglect in both trauma and attachment literatures (3). Severe homeostatic alterations(i.e., inability to adapt to stress) negatively impact maturation of subcortical and cortical areas of the postnatally developing temporal and prefrontal cortices, particularly in the right hemisphere. Relational trauma that induces severe neuroendocrine alterations during critical periods of right brain growth can lead to decreased cortico-subcortical neuroconnectivity between the amygdala and orbitofrontal (ventromedial) cortex, thereby compromising normal limbic mnemonic, cognitive, and affect regulatory functions. Early trauma is "affectively burnt in" the right frontal lobe.

Traumatic stressors trigger states of hyperarousal in the emotion-processing limbic system and autonomic nervous system, biochemically expressed in elevated levels of arousal-regulating catecholamines, corticotropin-releasing factor, corticosteroids, and hyperactivation of the excitotoxic NMDA (N-methyl-D-aspartate) glutamate receptor, a critical site of neurotoxicity and synapse elimination in early development. Trauma-induced increased apoptotic developmental cell death and excessive parcellation of maturing limbic-autonomic circuits represent a potent psychoneurobiological mechanism. By such neuroendocrinal and behavioural mechanisms, interpersonal stress experienced during gestation and postnatally can translate to short- and long-lasting biobehavioural response impairment in adult offspring. Studies on the affects of maternal prenatal stress indicate that repeated HPA axis activation and associated high serum levels of endogenous corticosteroids lead to diverse abnormal symptoms in infants including asocial behaviour and HPA dysregulation. Such alterations in maternal care can affect the expression of specific genes that regulate endocrinal and behavioural responses to stress causing increased vulnerability to disease, a range of psychophysiological disorders, and impaired neurogenesis. Even a single exposure to threat can create life-long changes in neural organization and behaviour (20).

Trauma shifts attachment processes from growth-promoting to growth-inhibiting, thereby creating conditions for unmediated hyperarousal, a vulnerability to posttraumatic stress disorder (PTSD) in adulthood, and a pre-disposition to violence that can express in diverse behaviours (3) and may be particularly important in highly social species.

> The development of proficiency in the regulation of fear and aggression appears to be especially important for those advanced....species whose members live in large social groups..(pp37;15).

Recurring and developing symptoms can be extensive and enduring leading to posttraumatic stress disorder (14; Table 1) that can perpetuate across generations. For example, under conditions selection for asocial heritable traits in the absence of normal socialization may increase under adverse conditions (15). Further, studies on emotion and stress dysregulation effects on memory suggest social learning will also be affected.

Interrelatedness and its Implications for Psittacines

We have discussed how a shared neurophysiology among vertebrates allows us draw parallel inferences on the effects of trauma and stress on brain-behaviour development in psittacines. In summary then, we can review how these concepts of trauma contribute to understanding parrot behaviour and health.

Trauma theory underscores how psychological conditions and experiences can last throughout a lifetime by affecting health and emotional capacities. Generally in the past, animals have been judged to cope better with stress and adverse conditions. This maxim conflicts with the massive accumulation of vertebrate neuroethological data demonstrating that animals indisputably feel pain, have emotional and psychological lives, and suffer accordingly to disruptions and trauma much like humans. Therefore what we do to parrots and how we raise them—what they experience—remains a legacy; what humans impose on parrots and what it causes may not be easily reversed or ameliorated.

Trauma and attachment theory together make it clear most parrots' lives in captivity are calibrated by trauma. If behaviour and conditions in the wild (where human intervention has been minimal) are used as a baseline to define "normality", then from the perspective of trauma and attachment theories and definitions of trauma (13), all to most domestic parrots experience a series of traumatic events and deprivation. Examples include:

- the process of capture from the wild that entails not only psychological trauma but physical hardship

- usually permanent disruption of flock structure and members
- existence in highly reduced social environment
- shifting households and human families
- psychological and physical deprivation (e.g., inadequate living conditions, abuse, injury, isolation)
- impaired rearing conditions

This list indicates that even if parrots are "well-cared for," their capture or captive rearing experience has likely left indelible marks that shape future abilities to form relationships as well as provide predictors on how they react to stress. Captive psittacids are required to change their behaviour, diet, and nearly every aspect of life to accommodate the human culture in which they live. Captivity itself, therefore, must be recognized as a marked deviation from patterns which their psychophysiology has evolved. Domestically situated parts live in a human culture, not a parrot culture.

It is also important to note that in most circumstances, captive psittacids sustain long periods of stress. Comparisons of confined laboratory and free ranging animals show that two conditions are necessary for behavioural changes to increase survival and diminish stress. Individuals must markedly change their behaviour when experiencing adverse stimulation and these changes have to be effective at avoiding future threat encounters. However, for captive parrots, after initial trauma, options to evade threat or ameliorate adverse conditions are blocked or are extremely limited. Most parrots are caged, have limited egress from an abusive human, live in impoverished conditions and social isolation. These are the conditions that define their world, lives, and psyches. Hence, we see parrots who thrash in their cages, who refuse to exit their cages, and who bite those who invade their perceived cage territory. Behaviour mirrors environment and experience.

Again from the perspective of trauma and attachment theories, what are observed as behaviour disorders are likely to reflect both trauma that can manifest as posttraumatic stress (see Tables 1 and 2) as well as an inability to effect some sort of recovery. In other words, observed behaviour needs to be regarded as having possible proximal and distal aetiologies. While, a given behaviour or symptom may have several possible aetiologies, trauma theory advises that while much can be accomplished by the human companion learning "parrot friendly" behaviour, there are cases where psychological scars remain. It may be that many persistent behaviourial problems (e.g., perennial feather picking) attest to such difficulties in amelioration and are symptoms of deeply engrained adaptations to a distant, but lingering, experience of trauma. Looking to human counterparts in longitudinal studies, the effects of trauma are persistent. Many individuals survive but struggle with depression, suicide, and other behavioural dysfunctions their entire lives. Furthermore, their children and families exhibit similar symptoms including domestic violence.

Trauma theory has application beyond *ex situ* settings. Even in the wild, parrots today increasingly exist under conditions lying far outside historical patterns and limits. For example, trauma and attachment theories support other research that argues against "sustainable harvesting" currently being proposed as a conservation option for the Blue-fronted Amazon (http://worldparrottrust.org/news/fwpost.htm). Such notions are deeply flawed and are by no definition "sustainable". Actions that create traumatic disruptions will severely perturb the population not only from the perspective of reducing numbers but by breaking down stable structures and processes that define a social species such a psittacines. Such effects have been observed in other species such as dolphins; even when anthropogenic disturbance (i.e., boats and nets) cease, behaviours remain abnormal, reproduction rates and population increases remain depressed.

Trauma and attachment theories also impress that the effects from systematic killing—harvesting—can transmit through the extant flock and across generations. Even stress experienced during gestation can translate to short- and long-lasting biobehavioural response impairment in adult offspring. What these findings imply is that both *in situ* and *ex situ* conservation need to expand concepts of species viability and fitness to include sociality (21) as well as biophysical factors.

Trauma and Interspecies Relationships

Implicit in all discussions of captive psittacines are interspecies relationships. What do trauma and attachment theories imply for companion parrot-human relationships and avicultural practices? Avian veterinarians have been very active in communicating the critical role that human behaviour has on companion parrot behaviour. By articulating mechanisms that link neurophysiology, psychology, and behaviour, brain research underscores even more how quality care is vital in every detail during neonate development. Attachment studies indicate that parent-child interactions are finely tuned and keyed in to minute changes in facial and body expression, touch, pheromones, and language. Deviations in the form of inadequate or incorrect responses by the human caretaker as the infant grows may have significant negative impacts on brain-behaviour development. Indeed, these ideas are consistent with the experience of many aviculturists and behaviour professionals who observe impaired function (e.g., young (baby) parrots who remain in a stupor and uncreative) because of rearing techniques that fail to sufficiently emulate parrot parents (11).

The quality and type of parrot attachments affect the individual at all stages of life. Parrots are defined by a social life that is varied and heterogeneous. Adults parrots in the wild spend most of their time in a social setting either as pairs, rearing young, or engaging with the larger flock. Wild flock members can have multiple functions presumably accordingly to their age, gender, social standing, abilities and individual preferences. Some members may be good whistlers and look outs, while others may excel as good food "scouts". Like other social species, an individual parrot's personality, personae, genetics, and experience—all of which are affected by social interactions--influence their susceptibility to stress, stress reactivity and ability to cope with change and recovery. Research on multiple species documents how an intact functioning social order helps buffer trauma by offering emotional and physical resources for recovery. For example, nonhuman primates, elephants, cetaceans, and other highly social animals all engage in grieving and mourning rituals which have been found to play an important role in restoring an individual to what is considered normative, under wild conditions, behavior and health.

> The core experiences of psychological trauma are disempowerment and disconnection from others. Recovery, therefore, is based upon the empowerment of the survivor and the creation of new connections…[that] must be reformed in…relationships (pp134, 13).

Practically, the reproduction of a flock may not be possible in many household. Therefore, because most parrots live without contact with other conspecifics, the role of the human companion is a, if not *the*, pivotal factor in healing from trauma. However, in most captive settings, parrots are without a re-building social structure of the flock and sadly, in all too many cases, they are not even provided with any recuperative structures, human or otherwise. The captive birds who live in isolation without contact with conspecifics and have extremely limited engagement with humans are unfortunately also those who are less likely to receive the attentions of avian veterinarians. Further, although the intent to care properly for the captive bird may be present, it nonetheless may be insufficient for a parrot. Like humans, birds do not thrive behind bars without love and support of committed relationships.

Human caregivers are challenged to re-create as best possible flock conditions or what in essence a flock provides. Understanding flock function and diversity and the ways in which each individual parrot is influenced by the larger social aggregate psychologically and physically will help inform humans how best to support their companion parrot. How a bird and their human companion learn to live biculturally will influence the bird's susceptibility to disease, their ability to be with different owners if needed, and the multitude of factors that dominate a captive parrot' life.

Much is still unknown about intra- and inter-flock socialization and relationships that needs to be studied to enhance the abilities of human caretakers. It is in this area that field researchers can contribute much to captive care knowledge. Hopefully the fact that a shared neurophysiology and sociality is ubiquitous among vertebrates will bring attention to the need for research doc umenting more details on intra-specific interactions and relationships in wild psittacines. Humans are in a position of stewardship of parrots whether they be researchers, companion parrot owners, veterinarians or aviculturists. If there is a hope that these magnificent animals will remain on this planet, it is our responsibility to honour their culture and respect, and perhaps emulate, their commitment to relationships.

Table 1: General Categories and associated symptoms (after van der Kolk et al, 1996 (14))

1. Intrusive re-experiencing—includes flashbacks, somatic sensations and affective states, reenactments, themes in behaviour changes
2. Autonomic hyperarousal—includes abnormal startle response
3. Numbing of responsiveness---includes depression, anhedonia, helplessness (loss of agency), stereotypies, loss of or reduced ability for meaningful relationships, dissociation, asociality (interpersonal relationship disorders relative to a "norm")
4. Intense emotional reactions—expression of fear, anxiety, anger, and panic to "minor" stimuli, sleeplessness, appetite disorders,
5. Learning difficulties—expression of infantile or lack of mature behaviours
6. Memory disturbances and dissociation—appearance of multiple personalities, fight-flight behaviour, defensiveness
7. Aggression against self and others—includes self-mutilation hyper-aggression , abusive behaviour and violence against others
8. Psychosomatic reactions—physical ailments related to emotive states. Included here are ailments that embody the trauma. This means that there are cases and expectations that some physical symptoms can subside if and when trauma is processed.

Table 2: Symptoms of Posttraumatic Stress with Possible Examples

Symptoms	***General description (defined for humans)***	***Possible Parrot behaviour***	
Depression	A mental state characterized by sense of inadequacy, withdrawal, despondence and	Cessation of appetite; withdrawal, unresponsiveness	

	inactivity		
Anhedonia	Inability to engage in or feel pleasure	Babies that "don't wake up"; failure to thrive	
Asociality	Agonistic, indifferent or hostile behaviour towards another	Male killing young, egg killing	
Hyper-aggression	Behaviour intended to inflict injury or death of another	Inter or intra-specific aggression, biting	
Self-mutilation	Conscious or unconscious behaviour that endangers well-being of self	Feather picking, chewing feet	
Exaggerated startle response	Hyper-arousal to "neutral" everyday noises or actions	Sudden and incessant screaming	
Intrusive ideation	Traumatic events insert into everyday life exemplified by nightmares, sudden violent behaviour	"stable" couple, male suddenly kills female	
Dissociation	Compartmentalization of experience, sometimes the appearance of "multiple personalities"	Stereotypy	
Psychosomatic reactions	Physical ailments associated with emotional experience	Symptoms that appear to have no identifiable aetiology	

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