

## INSIDE THE MINDS OF BIRDS: Tantalizing Clues about the Causes of Neurotic Feather Plucking and Self-Mutilation in Parrots

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All of us who love parrots worry about feather barbering and plucking, and their possible progression to self-mutilation (SM). After ruling out medical disorders, we are often left with “idiopathic” syndromes ( syndromes of unknown cause) , a fact which makes them even more upsetting. The majority of these seem to be “neurotic” in nature, but applying this label, or “psychogenic ”, doesn’t provide insights into the actual cause and therefore doesn’t help to identify rational treatments. However, recent articles from three separate groups of investigators begin to paint, in the aggregate, a picture of what might, literally, ‘go on in the mind’ of a feather plucker.

### I. **Brain neurochemicals:**

A series of studies by Nicholas Dodman at Tufts are summarized in two review articles (Refs. # 1, 2). As the reader doubtless is aware, trichotillomania is the common practice in people of twirling and then pulling out hair; it is usually preceded by a sense of tension, and followed by a sense of relief or even pleasure. It is considered by many to be a minor form of obsessive-compulsive disorder (OCD) with mild SM. Dodman studies potential animal models of trichotillomania. These include repetitive or ritualistic limb licking , obsessive chewing or flank sucking in dogs; and compulsive self-grooming (leading to fur loss) with paw, lip, or nose licking in cats . Analogous models also exist in horses, pigs, bulls and primates. He considers feather plucking in birds to be one of the best models; others (ref #3) have also made this comparison. It is important to note that some simple repetitive movement disorders called “stereotypies” are felt by Dodman to possibly be associated with similar causes in brain chemistry as OCD. However, since others find differences between OCD and stereotypies, the latter will not be discussed further in this brief article, except insofar as they may also be a somewhat different outcome reflecting the same stresses caused by the inadequate environmental conditions of captivity .

OCD may precede or coincide with sexual maturation and may sometimes be associated with aggression (although the latter link has not been documented in birds). Dodman points out that the actual external cause is often “exposure to suboptimal environmental conditions in which the animal is faced with irresolvable conflicts.” Interestingly, he notes that birds often pull a feather, inspect it, sometimes chew and shred it, play with it, and then discard it (almost as

if it is a toy!). I have seen my Cape parrot do this during a recent episodes of psychogenic plucking. In fact, the inspection and chewing of removed hair are also among the DSM-IV diagnostic criteria for human trichotillomania. Go to a library and you will see similar behavior in some human “twirlers/pluckers” during intense studying for exams. Note that these feather grooming disorders are essentially absent in Australian cockatoos (Ray Ackroyd ; Personal Communication) and Moluccan cockatoos (Buce Makatita; Personal Communication) in the wild. However, eventually, when the “source of the conflict is removed, the behaviors may continue to be performed repetitively and pointlessly without a stimulus,” an observation perhaps explained by the second article (see below).

Dodman goes on to note that OCD both in humans and in animals sometimes responds to drug treatment , especially with those such as fluoxetine [Prozac] and clomipramine. These which agents block the reuptake of the neurochemical serotonin back into nerve endings, thereby allowing it to accumulate to higher concentrations at its site of action. In the studies of Dodman and others (#1, 4), the response rate to fluoxetine was 60-100% in birds with feather plucking , although responses were frequently only transient and incomplete . Although others did not report such good results in an earlier small trial using clomipramine (cf. Ref #5), one did report weight gain in 4 of 10 treated parrots, which is compatible with the known role of serotonin in appetite control. These finding suggest that at least a subset of feather plucking disorders is mediated by changes in specific chemicals in the brain.

### **HYPOTHESIS A:**

These studies suggest that captivity, especially when complicated by social and sensori-behavioral deprivation (ie, loss of flock structure; absence of flight or food foraging) can lead to feather plucking which might , at least in part, be mediated by suboptimal concentrations of serotonin (or other neurotransmitters) in critical regions of the brain. Further progression of chemical imbalances might contribute to progression to self-mutilation . In fact, certain human disorders such as Tourette’s Syndrome (which has been linked to disordered brain serotonin and dopamine metabolism) may be associated with SM. As with alcoholism in humans, this behavior is remitting and relapsing and may be provoked by new stresses, even when they are not identifiable.

But why does plucking and even picking/self-mutilation often persist, even after conditions are improved for the parrot?

### **II. Structural Changes in the Brain:**

Workers at University of California-Davis may have provided (#6,7) some fascinating clues—and the second piece of the puzzle. Drs. Meehan, , Mench, and Garner have studied the effect of environmental enrichment on feather

plucking and fear responses in Orange-winged Amazon parrots—a species not particularly susceptible to feather plucking. At four months of age, birds were assigned to a control or “enriched” cage environment; their behavior was observed for one year through the use of video cameras. *The major factor in this ‘enrichment’ was the opportunity to use foraging skills for food*. Meehan (Ref. #6) has pointed out that parrots in the wild forage 4-6 hours a day for food; in captivity, her Orange-winged Amazons spend only 30-70 minutes.

These workers observed that environmental enrichment led to significant reductions in plucking, fear responses to novel stimuli (and stereotypies). This work confirms findings of others who studied Crimson-bellied conures (ref. #8). In a “cross-over” design, ‘control’ birds were then provided with an enriched cage environment; this led to a partial *reversal* of the aberrant behavior, at least if the change was made relatively *shortly after it had been established*. Interestingly, in a companion study, they concluded that stereotypies were associated with responses on a behavioral test which are usually taken to be indicative of actual *damage to a specific area of the brain* (the basal ganglia) associated with metabolism of dopamine—another neurochemical related to movement.

Although their studies are ongoing, the investigations of Meehan *et al* suggest that plucking can be, at least in part, caused or worsened by environmental impoverishment. It can be prevented—but, once established, it can be only partially and slowly reversed by environmental enrichment. The diminished fear responses observed by these authors after environmental enrichment lend credence to the observations of Dr. Tammy Jenkins( Ref. #9) that, in some cases, “the feather picking bird exhibits signs of excessive fear or stress. Fear, phobias, or panic may be displaced and translated into picking behavior.” In other words, phobic responses and OCD may be linked in their causation in some birds.

### **HYPOTHESIS #B:**

Early on, especially in young parrots, plucking and other disorders might be *reversible* and therefore “functional” in nature. However, over time, changes may occur in brain anatomy (as indicated by the onset of stereotypies), leading to diminished or little reversibility. Therefore, a logical inference is that enrichment should be provided to parrots from the earliest possible age or must be restored as soon as possible. If not, the degree of reversibility might diminish (whence the recurrence of plucking without obvious stimuli) and the responses to even drug therapy might become less favorable. Later, excessive fear, phobias, and even picking (possibly progressing even to recurrent self-mutilation) might ensue.

But still, what might be driving the changes in brain neurochemistry or anatomy?

### **III. Changes in Neurons and Genes in the Brain:**

The third link may be seen in a fascinating and provocative study carried out by Drs. Mario Capecchi and Joy Greer from the University of Utah Medical School (ref# 10).

The authors created genetically altered strains of mice which lacked a gene called *hoxb8* (“knock-out mice”). The mice looked normal, but 100% of them groomed and bit themselves persistently, removing hair and finally creating bald patches and open, deep skin wounds. These findings confirm those of other investigators. The authors liken the more minor changes to human trichotillomania; the similarity to OCD and SM in psittacines is also obvious. The investigators also found that the *hoxb8* genes were expressed (functioning) in areas of the brain controlling obsessive-compulsive behaviors! This is the first study of which I am aware, identifying a “grooming” gene and showing that OCD and SM result when that gene is impaired.

Could changes in the brain cells occur in the captive parrot without any direct injury to its brain? Quite possibly: Dr. Fernando Nottebohm of Rockefeller University recently reported that birds (adult zebra finches) housed in a large colony developed 30% more nerve cells in the sound-processing area than those housed in isolation (Ref.# 11). This finding indicates that the presence or absence of social interaction can affect the *numbers* of nerve cells (in other words, the very size and anatomy of the brain) ! It seems that there is not only safety in flock numbers, but better brain development.

### **HYPOTHESIS #C:**

It seems possible that when birds are kept in captivity (with inadequate socialization and enrichment, and lack of allo-preening), they over-compensate by excessive auto-preening.

Perhaps this overcompensation or exaggerated social replacement behavior is due to dysfunction or even actual death of neurons controlled by the *hoxb8* gene, which in turn ( I would speculate) might control neurotransmitter physiology (especially that of serotonin, but probably also others such as endorphins and dopamine) .

However, once structural changes in the nerves occur over time and they eventually die (note that *hox* genes also control the development of embryonic nerves), the process becomes largely irreversible, even when changes in the environment are made. Furthermore, the brain cells which respond to drugs such as Prozac by increasing levels of serotonin have degenerated and so are now unresponsive to pharmacologic therapy.

It is interesting to speculate that birds—such as Moluccan cockatoos, African greys, lovebirds—which seem especially prone to chronic plucking and self-mutilation-- might have a genetic susceptibility of their “grooming nerves” to dysfunction or destruction. I once happened to ask Dr. Darrel Styles about how best to go about studying the causation of the Self-Mutilation Syndrome. He said that one would have to carry out detailed breeding studies, because genetics was likely to play a critical role. The studies of Capecchi and Greer lend further credence to this.

### **PRACTICAL CONCLUSIONS:**

If this three-part hypothesis can be confirmed through additional studies, there are obvious practical ramifications. To the degree that such studies can be extrapolated to the syndromes of feather plucking and self-mutilation in captive psittacines , I would suggest that they imply the following tentative conclusions:

1. Lack of enrichment (including lack of foraging) can induce OCD, including at least plucking,. This aberrant behavior can be prevented or reversed , early on and/or in young birds, by providing enrichment. In addition, providing a natural flock environment can actually promote brain growth. ***Initiating enrichment early on, at a young age, seems to be a critical variable.*** As the socio-sensory and behavioral deprivation becomes more prolonged and/or the bird ages, the degree of reversibility is reduced.

Dr. Meehan and colleagues are currently completing a study comparing fluoxetine (Prozac) to enrichment (alone and in combination) on the potential reversal of OCD and stereotypies in older (6-11 yrs) Amazons.

2. Meehan points out (Ref. #6) that toys (at least when used for the purpose of enrichment) should be chosen from the *parrot's viewpoint*, not the human's. She suggests that brightly colored toys, specially shaped toys and even puzzles may not be effective if they do not “require that the parrot utilizes its natural skills [and] mimic the contingencies of the natural environment.” She suggests we need to develop more insight into the kind of toys which would provide enough stimulation to prevent OCD, stereotypies, and SM.
3. Note that an extension of these conclusions is that *absence of adequate socialization during the mass “production” of parrot chicks* (a term Sally Blanchard has labeled “poutrification”) *might be a major predisposing factor for later OCD.*
4. OCD in parrots may be associated with disorders of brain chemistry similar to those seen in people and therefore may respond, at least in part, to drugs modifying brain neurotransmitter function. Stereotypies is probably a different manifestation of captivity, perhaps attributable to changes in a different

neurochemical (?dopamine) , but nonetheless its presence may provide a ‘red flag’ or ‘marker’ for the need to *urgently* address the deprivation of the parrot. Self-mutilation might reflect the severity and/or duration of the precipitating causes—ie, reaching the point where brain cells or their genes actually ‘drop out’.

5. As the OCD persists, it becomes less reversible. This may be due to the actual loss of genes and brain cells in critical areas which control obsessive-compulsive behavior and/or its brain chemistry. It seems possible that mutations in these genes might render certain species, or individual birds, more susceptible to OCD and Self-Mutilation Syndromes.
6. Once the syndrome becomes “fixed”, there is always a risk of recurrence, as in human alcoholism. The ‘pleasure’ birds seem to take in what would otherwise be considered noxious rituals (feather-plucking; SM) suggest that perhaps the pain releases endorphins which cause an addiction of sorts to the behavior. If so, treatment with opioid antagonists might be of value.
7. However, this categorically *does NOT mean* that at this stage, treatment is not valuable or that the parrot should be placed in a sanctuary or, worse, “euthanatized.” Nor is it possible to ascertain, at this stage of our knowledge, which birds are at the ‘reversible’ stage and which are not. A number of people who rescue and/or treat parrots with severe plucking, picking and/or self-mutilation have seen encouraging results by providing a combination of excellent veterinary care (with drug therapy being a temporary and probably last-ditch approach in the severe case); tender loving care and/or a flock situation; environmental enrichment (food foraging; toys; possibly indoor or even free-flight; wood for chewing; socialization with a variety of people , exposure to the outdoors, and so on) and *lifelong vigilance*.

I have learned first-hand about the excellent (albeit often only incomplete and/or recurring) results of such care by watching and learning from others (see ref. # 12). And there are many others who, I’m sure, have similar experiences. As we learn more about the causes of these frustrating syndromes and act on that knowledge, hopefully the epidemic in OCD in caged birds will be markedly reduced.

*WE ARE CAUSING THIS PLAGUE; WE MUST BE THE REMEDY.*

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