INTRODUCTION
Very often the first sign that an animal is experiencing a health problem is a change in their behavior. Most commonly these are changes in eating habits, elimination habits and activity levels. Behavior can also change profoundly due to sensory changes (loss of hearing or sight), pain or cognitive decline. Various physical and physiological changes can cause changes in behavior and are discussed below.

NEUROLOGICAL
Often a change in mood, behavior or responsiveness to stimuli can be the first sign of a neurological disorder. Involvement of the forebrain in the disease process can result in loss of learned responses while alterations in awareness might involve the brainstem. Sensory or motor dysfunction may also contribute to decreased responsiveness to stimuli. Changes in emotional responses and emotional state may occur with a disease involving the limbic system or hypothalamus.

Any disease or inflammation that involves the Central Nervous System (CNS) can affect behavior. Problems may arise due to intracranial disease (neoplasia, degenerative disease, congenital disorders) or from extracranial causes (toxins, endocrinopathies, or circulatory problems). In these situations changes in cranial nerve function, tremors, sensory deficits or motor deficits may or may not be noted. Various types of seizure disorders can also cause changes in behavior. Temporal lobe seizures, complex or partial seizures may occur without significant changes in affect in between episodes. The clinical signs of air snapping, tail chasing, staring, head shaking, spinning or checking body areas may represent a seizure disorder or a compulsive disorder requiring that all possible medical causes be investigated and perhaps a trial with anticonvulsant medication attempted prior to giving a behavioral diagnosis.

Hydrocephalus is common in certain breeds of dogs and may be congenital or acquired. Hydrocephalus often manifests as behavioral signs including abnormal behavior, inability to become house trained, cognitive dysfunction and circling, seizures and more.

Neurogenic pain has not been well established in animals, but may also account for changes in affect and behavior.

ENDOCRINE
Endocrinopathies are common in companion animals. Disorder of the thyroid gland (hyper or hypo thyroidism) and the adrenal gland (hyper or hypo adrenocorticism) are most often diagnosed in dogs and cats. The relationship between thyroid function and behavioral abnormalities is often stated, but little evidence exists to document a causative relationship. A controlled study found no significant differences in an eight-analyte thyroid panel between two groups of dogs; one diagnosed with aggression and one without aggression. Supplementation with thyroid medication should be avoided in behavior cases unless laboratory evidence (complete panel with Total Thyroxine, free thyroxine and triiodothyronine, thyrotropin and antithyroid antibodies) warrants such intervention. Hyperthyroidism is quite common in companion cats and may cause hyperphagia, polydypsia, polyuria and loose stools. Diseases of
the adrenal gland may result in alterations of stress hormones or testosterone, both of which may affect behavior. Increases in testosterone may result in intact male behaviors (urine marking, aggression, mounting) in previously neutered animals and laboratory testing for blood testosterone levels will aid in diagnosis of these disorders.

**GASTROINTESTINAL/INGESTIVE**

Increases or changes in eating and drinking can occur with disease states (diabetes mellitus) or medication (prednisone), which may lead to food seeking behavior and perhaps pica in various individuals. Unusual oral behaviors (licking, gulping, sucking and lip smacking) may be manifestations of compulsive disorders but medical differentials must be rigorously investigated and eliminated.

**HOUSESOILING**

Medical problems may be the inciting or maintenance factors in house soiling in dogs and cats. Several studies are available that have investigated the influence of medical disease on house soiling and marking in cats. In a retrospective study of house soiling in cats sixty percent had a history of FLUTD/FUS. However another different study in urine marking cats noted no associated medical disease with marking. In dogs and cats medical problems (IBD, food allergies or intolerances, antibiotic responsive, diarrhea diabetes) can cause increased in urine or stool volume, decreased control and discomfort with elimination.

**PAIN**

Pain can come from any body tissue, can be acute or chronic and dramatically alter behavior. Acute pain is often caused by injury, trauma and surgical procedures and critical illness where the use of pain management is important in recovery. Most veterinarians seek to address surgical pain and osteoarthritis in dogs and cats. Numerous studies have been undertaken to assess the use of pain scales and pain control in both dogs and cats with osteoarthritis and some have shown validity. One common but often neglected symptom of osteoarthritis is a change in behavior, activity and mood. Most owners and many veterinarians only treat arthritis pain if the animal is limping or shows signs of lameness. However, many older animals have some form of degenerative changes in one or more joints. Hardie et al studied 100 geriatric cats > 12 years of age and examined radiographs for evidence of degenerative joint disease. She noted that 90% of cats over the age of 12 had degenerative joint disease in one or more joints. Additionally, neurologic disease was associated with lesions in the lumbosacral portion of the vertebral column. The distribution of arthritis in older dogs may be similar especially in some breeds known to be prone to arthritis as they age.

However, companion animals have compensatory mechanisms to mask the signs of pain making the diagnosis and the treatment of pain in animals more difficult for veterinary health care professionals and owners. Physical examination may not always reveal pain. The most common signs that indicate an animal is in pain tend to be behavioral: vocalizations, agitation, abnormal postures or gaits, and subtle signs such as loss of appetite, trembling, stupor or biting. Chronic pain may be accompanied by decreased activity, depression and lameness. The education of the pet owner is of prime importance so that they will report changes from normal behavior that might signal pain or illness. Alterations in behavior and demeanor are often associated with pain in dogs and may sometimes be the initial or primary sign. Cats may mask pain a bit better, perhaps because they are lighter, more agile or pain maybe bilateral. Changes from normal behavior in cats might be signs of pain and include changes in activity, social interactions and play, house soiling, vocalization or a change in temperament (e.g. aggression, avoidance). The veterinary staff must monitor hospitalized patients closely for signs of pain.
utilizing body postures, vocalization, mobility and gait (the latter may be difficult to assess in caged or immobile animals).

Treating pain is essential in companion animals\textsuperscript{15} and may improve behavior, but other learned components may remain especially if they are successful in changing the outcome of situations.

**DERMATOLOGICAL**

Self-traumatic lesions are common in veterinary medicine and include biting, chewing, scratching, licking or excessive barbering leading to skin lesions and alopecia. Medical differentials include: diseases causing pain or pruritus (e.g. hypersensitivity reactions, neuropathies), infections (e.g. bacterial, fungal, and parasitic), endocrinopathies, tumors, immune mediated diseases, neoplasia, or skin disorders associated with systemic diseases (e.g. hepatocutaneous syndrome). In acral lick dermatitis in dogs, food intolerance, deep pyoderma, tumors, trauma, protozoal and fungal infections may all be factors. Dermatological lesions in cats can result from vigorous grooming efforts linked to the fastidious nature of most cats. The ability to differentiate normal grooming from excessive grooming can be difficult\textsuperscript{16}. Potential differential diagnoses include skin conditions (allergies, parasites, and infection), neurological conditions (psychomotor seizures) and behavioral conditions such as compulsive behaviors, attention seeking and anxiety\textsuperscript{17}. Feline hyperesthesia is a complaint that may arise from any number of medical or behavioral causes including dermatologic diseases, spinal disease.

**STRESS AND BEHAVIOURAL HEALTH**

Chronic anxiety and stress have been implicated in behavioral disorders in humans including panic disorders, separation anxiety, social and other phobias, obsessive-compulsive disorders, generalized anxiety disorders, post-traumatic stress disorders, impulse control disorders, and sleep disorders. Many of these same signs are seen in companion animals and they too are likely to show altered behavioral patterns due to stress\textsuperscript{18,19}. Displacement behaviors such as self-trauma, spinning, tail chasing or hyperesthesia might be exhibited if the animal is experience conflict (competing motivations), frustration (inability to achieve their goals) or when the behavioral needs of the animal are not met. These signs are more likely to arise in pets that are anxious or reactive and those that are genetically predisposed. If these displacement behaviors are exhibited outside of the original context, and do not seem to be under the pet’s control for initiation or termination, they often become compulsive disorders. A compulsive disorder is a behavior that is performed excessively, out of context and interferes with the ability of the animal to function in the day to day environment.

**SUMMARY**

When presented with a behavioral complaint by an owner, it is important to always look for any possible medical problems that could be causative or existing concurrently. If both the medical and behavioral aspects are not identified and treated, improvement and resolution may be compromised.
<table>
<thead>
<tr>
<th>Medical condition presentation</th>
<th>Behavioural signs – examples</th>
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<tbody>
<tr>
<td>Neurologic – Central (intracranial / extracranial) particularly if affecting forebrain, limbic/temporal and hypothalamic; REM sleep disorders</td>
<td>Altered awareness, response to stimuli, loss of learned behaviors, house soiling, disorientation, confusion, altered activity levels, temporal disorientation, vocalization, soiling, change in temperament (fear, anxiety), altered appetite, altered sleep cycles, interrupted sleep</td>
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<tr>
<td>Partial seizures – temporal lobe epilepsy</td>
<td>Repetitive behaviors, self-traumatic disorders, chomping, staring, alterations in temperament (e.g. intermittent states of fear or aggression), tremors, shaking, interrupted sleep</td>
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<td>Sensory dysfunction</td>
<td>Altered response to stimuli, confusion, disorientation, irritability / aggression, vocalization, house soiling, altered sleep cycles</td>
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<td>Endocrine – hyper or hypo thyroid, hyper or hypoadrenocorticism, insulinoma, diabetes, testicular or adrenal tumors</td>
<td>Altered emotional state, irritability / aggression, lethargy, decreased response to stimuli, anxiety, house soiling / marking, night waking, decreased or increased activity, altered appetite, mounting</td>
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<tr>
<td>Metabolic disorders – hepatic / renal</td>
<td>Signs associated with organ affected – may be anxiety, irritability, aggression, altered sleep, house soiling, mental dullness, decreased activity, restlessness, increase sleep, confusion</td>
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<td>Pain</td>
<td>Altered response to stimuli, decreased activity, restless / unsettled, vocalization, house soiling, aggression / irritability, self-trauma, waking at night</td>
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<td>Peripheral neuropathy</td>
<td>Self-mutilation, irritability/aggression, circling, hyperesthesia, house soiling</td>
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<td>Gastrointestinal</td>
<td>Licking, polyphagia, pica, coprophagia, fecal house soiling, wind sucking, tongue rolling, unsettled sleep, restlessness</td>
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<tr>
<td>Urogenital</td>
<td>House soiling (urine), polydypsia, waking at night</td>
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<tr>
<td>Dermatologic</td>
<td>Psychogenic alopecia (cats), acral lick dermatitis (dogs), nail biting, hyperesthesia,</td>
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9 Simpson KW, Jergens AE Pitfalls and progress in the diagnosis and management of Canine Inflammatory Bowel Disease. In. VCNA Chronic Intestinal diseases of the dog and cat Ed. FP Gaschen, Elsevier 41:2 381-398