Drug Interactions
The following drug interactions have either been reported or are theoretical in humans or animals receiving cetirizine and may be of significance in veterinary patients:

- **CNS DEPRESSANTS:** Additive CNS depression if used with cetirizine

Laboratory Considerations
- None noted, however discontinue medication well in advance of any **hypersensitivity skin testing**

Doses
- **DOGS:**
  a) For atopic dermatitis: 1 mg/kg PO once daily with or without food. Satisfactory control of pruritus in 18% of dogs evaluated in the study. (Cook, Scott et al. 2004)
  b) For atopic dermatitis: 5–10 mg (total dose) PO once daily (Thomas 2005a)
  c) For allergic dermatitis: 1 mg/kg PO q12h (Hillier 2004)
- **CATS:**
  a) For adjunctive treatment of non-responsive chronic rhinosinusitis: 5 mg (total dose) PO q12h (Hawkins and Cohn 2006)
  b) For adjunctive treatment of eosinophilic dermatopathies: 5 mg (total dose) PO q12h (Hnilica 2003b)
  c) For adjunctive treatment of pruritus: 2.5–5 mg (total dose) PO once daily. (MacDonald 2002a)

Monitoring
- Clinical efficacy
- Adverse effects (vomiting, somnolence)

Client Information
- Warn clients of the potential costs
- Potential adverse effects include GI effects (vomiting, hypersalivation) and somnolence
- May be given without regard to feeding status

Chemistry/Synonyms
Cetirizine HCl occurs as a white to almost white, crystalline powder that is freely soluble in water. A 5% solution has a pH of 1.2–1.8.

Cetirizine may also be known as: UCB-P071, P-071, cetirizina, cetirizini, cetirizin, ceterizino, or *Zyrtec*®; many internationally registered trade names are available.

Storage/Stability
Tablets should be stored at 20–25°C; excursions are permitted to 15–30°C. The oral syrup may be stored at room temperature or in the refrigerator.

Dosage Forms/Regulatory Status
VETERINARY-LABELED PRODUCTS: None

The ARCI (Racing Commissioners International) has designated this drug as a class 4 substance.

HUMAN-LABELED PRODUCTS:

Cetirizine HCl Tablets (film-coated): 5 mg & 10 mg; *Zyrtec*® (Pfizer), generic; (Rx)

Cetirizine HCl Chewable Tablets (grape flavor): 5 mg & 10 mg; *Zyrtec*® (Pfizer), generic; (Rx)

Cetirizine HCl Syrup: 1 mg/mL (banana-grape flavor) in 120 and 480 mL; *Zyrtec*® (Pfizer); (Rx)

Cetirizine HCl 5 mg with Pseudoephedrine HCl 120 mg Extended-Release Tablets; *Zyrtec-D 12 Hour*® (Pfizer); (Rx)

CHARCOAL, ACTIVATED

(***char***-kole) Toxiban®

ORAL ADSORBENT

Prescriber Highlights
- Orally administered adsorbent for GI tract toxins/drug overdoses
- Not effective for mineral acids/alkalis
- Too rapid administration may induce emesis/aspiration
- In small dogs & cats, monitor for hypernatremia
- Handle with care as charcoal stains clothing very easily; dry powder "floats"

Uses/Indications
Activated charcoal is administered orally to adsorb certain drugs or toxins to prevent or reduce their systemic absorption.

Pharmacology/Actions
Activated charcoal has a large surface area and adsorbs many chemicals and drugs via ion-ion, hydrogen bonding, dipole and Van der Walle forces in the upper GI tract thereby preventing or reducing their absorption. Efficiency of adsorption increases with the molecular size of the toxin and poorly water soluble organic substances are better adsorbed than small, polar, water-soluble organic compounds.

While activated charcoal also adsorbs various nutrients and enzymes from the gut, when used for acute poisonings, no clinical significance usually results. Activated charcoal reportedly is not effective in adsorbing cyanide, but this has been disputed in a recent study. It is not very effective in adsorbing alcohols, ferrous sulfate, lithium, caustic alkalies, nitrates, sodium chloride/chlorate, petroleum distillates or mineral acids.

Pharmacokinetics
Activated charcoal is not absorbed nor metabolized in the gut.

Contraindications/Precautions/Warnings
Charcoal should not be used for mineral acids or caustic alkalies as it is ineffective. Although not contraindicated for ethanol, methanol, or iron salts, activated charcoal is ineffective in adsorbing these products and may obscure GI lesions during endoscopy.

Adverse Effects
Very rapid GI administration of charcoal can induce emesis. If aspiration occurs after activated charcoal is administered, pneumonitis/aspiration pneumonia may result. Charcoal can cause either constipation or diarrhea and feces will be black. Products containing sorbitol may cause loose stools and vomiting.

There have been reports of hypernatremia occurring in small dogs and cats after charcoal (with or without sorbitol) administration, presumably due an osmotic effect pulling water into the GI tract. Reduced sodium fluids (*e.g.,* D5W, ½ normal saline/D2.5W) with warm water enemas can be administered to alleviate the condition.

Charcoal powder is very staining and the dry powder tends to "float" covering wide areas.

Overdosage/Acute Toxicity
Potentially could cause electrolyte abnormalities; see Adverse Effects for more information.

Drug Interactions

The following drug interactions have either been reported or are theoretical in humans or animals receiving charcoal and may be of significance in veterinary patients:

- **OTHER ORALLY ADMINISTERED THERAPEUTIC AGENTS:** Separate by at least 3 hours the administration of any other orally administered therapeutic agents from the charcoal dose
- **DAIRY PRODUCTS:** May reduce the adsorptive capacity of activated charcoal
- **MINERAL OIL:** May reduce the adsorptive capacity of activated charcoal
- **POLYETHYLENE GLYCOL; ELECTROLYTE SOLUTIONS** (*e.g.*, *Go-Lytely®*): May reduce the adsorptive capacity of activated charcoal

Doses

- **DOGS & CATS:**

As a gastrointestinal absorbent:

a) 10 mL of a 20% slurry (1 g of charcoal in 5 mL of water) per kg of body weight by stomach tube (Carson and Osweiler 2003)

For acute poisoning:

a) After decontamination of the GI tract give activated charcoal at 1–4 g/kg PO. Placement of a nasogastric tube can facilitate administration and reduce the incidence of aspiration in the sedated/fractious animal particularly when repeated administration is desired; repeat every 4–6 hours for toxins that are recirculated through the intestinal capillary network. (Rudloff 2006b)

b) 1–4 g/kg in 50–200 mL of water. Concurrent with or within 30 minutes of giving charcoal, give an osmotic cathartic. Repeated doses of activated charcoal may also bind drugs that are enterohepatically recycled. (Beasley and Dorman 1990)

c) Administer in a bathtub or other easily cleanable area. Give activated charcoal at 1–5 g/kg PO (via stomach tube using either a funnel or large syringe) diluted in water at a concentration of 1 g charcoal/5 –10 mL of water. Follow in 30 minutes with sodium sulfate oral cathartic. (Bailey 1989)

- **RUMINANTS:**

a) 1–3 grams/kg PO (1 gram of charcoal in 3–5 mL of water) via stomach tube; give saline cathartic concurrently. May repeat in 8–12 hours. (Bailey 1986b)

- **HORSES:**

a) Foals: 250 grams (minimum). Adult horses: up to 750 grams. Make a slurry by mixing with up to 4 L (depending on animal's size) of warm water and administer via stomach tube. Leave in stomach for 20–30 minutes and then give a laxative to hasten removal of toxicants. (Oehme 1987b)

Monitoring

- Monitoring for efficacy of charcoal is usually dependent upon the toxin/drug that it is being used for and could include the drug/toxin's serum level, clinical signs, etc.
- Serum sodium, particularly if patient develops neurologic signs associated with hypernatremia (tremors, ataxia, seizures)

Client Information

- This agent should generally be used with professional supervision; if used on an outpatient basis patients must be observed for at least 4 hours after administration for signs associated with too much sodium in the blood (weakness, unsteadiness, tremors, convulsions). Should these occur, patients must immediately be seen by a veterinarian.
- Charcoal can easily stain fabrics

Chemistry/Synonyms

Activated charcoal occurs as a fine, black, odorless, tasteless powder that is insoluble in water or alcohol. Commercially available activated charcoal products may differ in their adsorptive properties, but one gram must adsorb 100 mg of strychnine sulfate in 50 mL of water to meet USP standards.

Activated charcoal may also be known as: active carbon, activated carbon, carbo activatus, adsorbent charcoal, decolorizing carbon, or medicinal charcoal. There are many trade names available.

Storage/Stability

Store activated charcoal in well-closed glass or metal containers or in the manufacturer's supplied container.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS:

Activated charcoal 47.5%, Kaolin 10% granules (free flowing and wettable) in 1 lb bottles, and 5 kg pails: *Toxiban® Granules* (Vet-A-Mix); (OTC). Labeled for use in both large and small animals.

Activated charcoal 10.4%, Kaolin 6.25% suspension in 240 mL bottles: *Toxiban® Suspension* (Vet-A-Mix); (OTC). Labeled for use in both large and small animals.

Activated charcoal 10%, Kaolin 6.25%, sorbitol 10% suspension in 240 mL bottles: *Toxiban® Suspension* with *Sorbitol* Vet-A-Mix); (OTC). Labeled for use in small animals.

Activated Charcoal 10%, Attapulgite 20%, sodium chloride 35 mg/mL, potassium chloride 35 mg/mL Gel/Paste in 80 mL & 300 mL: *D-Tox-Besc®* (AgriPharm); *Activated Charcoal Gel with Electrolytes®* & *DVM Formula®* (Bomac Plus Vet), *Activated Charcoal Paste®* (First Priority); (OTC). Labeled for use in small and large animals.

Activated Hardwood Charcoal and thermally activated attapulgite clay (concentrations not labeled) in an aqueous gel suspension in 8 fl oz bottle, 60 mL tube and 300 mL tube with easy dose syringe. *UAA® (Universal Animal Antidote) Gel* (Vedco); (OTC). Labeled for use in dogs, cats and grain overload in ruminants.

HUMAN-LABELED PRODUCTS:

Activated Charcoal Powder: 15 g, 30 g, 40 g, 120 g, 240 g and UD 30 g (Activated charcoal is also available in bulk powder form); generic; (OTC)

Activated Charcoal Liquid/Suspension with sorbitol: 15 g & 30 g in 150 mL & 50 g in 240 mL; *CharcoAid®* (Requa); 25 g in 120 mL & 50 g in 240 mL; *Actidose® with Sorbitol* (Paddock); (OTC)

Activated Charcoal Liquid/Suspension without sorbitol: 15 g & 50 g in 120 mL & 240 mL; *CharcoAid® 2000* (Requa); (OTC); 208 mg/mL — 12.5 g in 60 mL & 25 g in 120 mL; 12.5 g in 60 mL, 15 g in 75 mL, 25 g in 120 mL, 30 g in 120 mL, 50 g in 240 mL; *Actidose-Aqua®* (Paddock); generic; (OTC)

Activated Charcoal Granules: 15 g in 120 mL; *CharcoAid® 2000* (Requa); (OTC)

CHLORAMBUCIL

(klor-*am*-byoo-il) Leukeran®

IMMUNOSUPPRESSANT/ANTINEOPLASTIC

Prescriber Highlights

- Nitrogen mustard derivative immunosuppressant & antineoplastic
- Used for severe autoimmune diseases in cats (*e.g.,* IBD, pemphigus, etc.) as it is less toxic than cyclophosphamide or azathioprine in cats
- Contraindications: Hypersensitivity to chlorambucil
- Caution: Preexisting bone marrow depression, infection
- Potential teratogen
- Adverse Effects primarily myelosuppression & GI toxicity

Uses/Indications

Chlorambucil may be useful in a variety of neoplastic diseases, including lymphocytic leukemia, multiple myeloma, polycythemia vera, macroglobulinemia, and ovarian adenocarcinoma. It may also be useful as adjunctive therapy for some immune-mediated conditions (*e.g.*, glomerulonephritis, inflammatory bowel disease, nonerosive arthritis, or immune-mediated skin disease). It has found favor as a routine treatment for feline pemphigus foliaceous and severe feline eosinophilic granuloma complex due to the drug's relative lack of toxicity in cats and efficacy.

Pharmacology/Actions

Chlorambucil is a cell-cycle nonspecific alkylating antineoplastic/immunosuppressive agent. Its cytotoxic activity stems from cross-linking with cellular DNA.

Pharmacokinetics

Chlorambucil is rapidly and nearly completely absorbed after oral administration; peak levels occur in about one hour. It is highly bound to plasma proteins. While it is not known whether it crosses the blood-brain barrier, neurological side effects have been reported. Chlorambucil crosses the placenta, but it is not known whether it enters maternal milk. Chlorambucil is extensively metabolized in the liver, primarily to phenylacetic acid mustard, which is active. Phenylacetic acid mustard is further metabolized to other metabolites that are excreted in the urine.

Contraindications/Precautions/Warnings

Chlorambucil is contraindicated in patients who are hypersensitive to it or have demonstrated resistance to its effects. It should be used with caution in patients with preexisting bone marrow depression or infection, or are susceptible to bone marrow depression or infection.

Adverse Effects

The most commonly associated major adverse effects seen with chlorambucil therapy is myelosuppression manifested by anemia, leukopenia, and thrombocytopenia and gastrointestinal toxicity. A greater likelihood of toxicity occurs with higher dosages. This may occur gradually with nadirs occurring usually within 7–14 days of the start of therapy. Recovery generally takes from 7–14 days. Severe bone marrow depression can result in pancytopenia that may take months to years for recovery. Alopecia and delayed regrowth of shaven fur have been reported in dogs; Poodles or Kerry blues are reportedly more likely to be affected than other breeds.

In humans, bronchopulmonary dysplasia with pulmonary fibrosis, and uric acid nephropathy have been reported. These effects are uncommon and generally associated with chronic, higher dose therapy. Hepatotoxicity has been reported rarely in humans.

Reproductive/Nursing Safety

Chlorambucil's teratogenic potential remains poorly documented, but it may potentially cause a variety of fetal abnormalities. It is generally recommended to avoid the drug during pregnancy, but because of the seriousness of the diseases treated with chlorambucil, the potential benefits to the mother must be considered. Chlorambucil has been documented to cause irreversible infertility in male humans, particularly when given during pre-puberty and puberty. In humans, the FDA categorizes this drug as category ***D*** for use during pregnancy (*There is evidence of human fetal risk, but the potential benefits from the use of the drug in pregnant women may be acceptable despite its potential risks.*) In a separate system evaluating the safety of drugs in canine and feline pregnancy (Papich 1989), this drug is categorized as in class: ***C*** (*These drugs may have potential risks. Studies in people or laboratory animals have uncovered risks, and these drugs should be used cautiously as a last resort when the benefit of therapy clearly outweighs the risks.*)

Overdosage/Acute Toxicity

The oral LD_{50} in mice is 123 mg/kg. There have been limited experiences with acute overdoses in humans. Doses of up to 5 mg/kg resulted in neurologic (seizures) toxicity and pancytopenia (nadirs at 1–6 weeks post ingestion). All patients recovered without long-term sequelae. Treatment should consist of gut emptying when appropriate (beware of rapidly changing neurologic status if inducing vomiting). Monitoring of CBC's several times a week for several weeks should be performed after overdoses and blood component therapy may be necessary.

Drug Interactions

The following drug interactions have either been reported or are theoretical in humans or animals receiving chlorambucil and may be of significance in veterinary patients:

- **MYELOSUPPRESSIVE DRUGS** (*e.g.,* **other antineoplastics, chloramphenicol, flucytosine, amphotericin B, or colchicine**): Bone marrow depression may be additive
- **IMMUNOSUPPRESSIVE DRUGS** (*e.g.,* **azathioprine, cyclophosphamide, cyclosporine, corticosteroids**): Use with other immunosuppressant drugs may increase the risk of infection

Laboratory Considerations

- Chlorambucil may raise serum **uric acid** levels. Drugs such as **allopurinol** may be required to control hyperuricemia in some patients.

Doses

For more information on using chlorambucil as part of chemotherapy protocols, refer to the protocols found in the appendix or other dosages/protocols found in numerous references, including: *Withrow and MacEwen's Small Animal Clinical Oncology, 4th Ed.* (Withrow and Vail 2007); *Canine and Feline Geriatric Oncology* (Villalobos 2007); *Small Animal Internal Medicine, 3rd Edition* (Nelson and Couto 2003); *Textbook of Veterinary Internal Medicine: Diseases of the Dog and Cat 6th Edition* (Ettinger and Feldman 2005); and *The 5-Minute Veterinary Consult Canine & Feline, 3rd Ed.* (Tilley and Smith 2004).

- **DOGS:**

  For adjunctive therapy (as an immunosuppressant) in the treatment of glomerulonephritis:

  a) 0.1–0.2 mg/kg PO once daily or every other day (Vaden and Grauer 1992)