Lufenuron 6 Month Injectable for Cats: 100 mg/mL in 10 syringe packages: 0.4 mL (40 mg) prefilled syringe (for cats up to 8.8 lb), 0.8 mL (80 mg) prefilled syringe (for cats 8.9–17.6 lb); *Program® 6 Month Injectable* (Novartis); (Rx). Approved for use in cats and kittens 6 weeks of age or older.

Lufenuron Oral Flavor Tabs for Dogs and Cats: For dogs up to 10 lb: 45 mg; For dogs 11 to 20 lb: 90 mg; For dogs 21 to 45 lb: 204.9 mg; For dogs 46 to 90 lb: 409.8 mg; Dogs over 90 lbs receive the appropriate combination of lufeneron tablets; For cats up to 6 lbs. 90 mg; 7–15 lb: 204.9 mg; cats over 15 lb. receive the appropriate combination of lufeneron tablets *Program® Flavor Tabs* (Novartis); (OTC). Approved for use in dogs, puppies, cats, & kittens (4 weeks of age or older).

Lufenuron and Nitenpyram Oral Tablets for Dogs: For dogs up to 10 lb: 45 mg Lufeneron, 11.4 mg nitenpyram; For dogs 11 to 20 lb: 90 mg lufenuron, 11.4 mg nitenpyram; For dogs 21 to 25 lb: 204.9 mg lufenuron, 11.4 mg nitenpyram; For dogs 26 to 45 lb: 204.9 mg lufenuron, 57 mg nitenpyram; For dogs 46 to 90 lb: 409.8 mg lufenuron, 57 mg nitenpyram; Dogs over 90 lbs receive the appropriate combination of Lufeneron tablets and 57 mg nitenpyram tablets; *Program® Flavor Tabs* and *Capstar® Flea Management System for Dogs* (Novartis); (OTC). Approved for use in dogs and puppies (6 weeks of age or older).

Lufenuron and Nitenpyram Oral Tablets for Cats: For cats 2 to 6 lb: 90 mg lufenuron, 11.4 mg nitenpyram; For cats 7 to 15 lb: 204.9 mg lufenuron, 11.4 mg nitenpyram; For cats 16 to 25 lb: appropriate combination of tabs provided lufenuron, 11.4 mg nitenpyram; *Program® Flavor Tabs* (OTC); and *Capstar® Flea Management System for Cats* (Novartis); (OTC)

Milbemycin/Lufenuron Oral Tablets with Nitenpyram Oral Tablets for Dogs: For dogs 2 to 10 lb: 46 mg milbemycin/Lufeneron, 11.4 mg nitenpyram; For dogs 11 to 25 lb: 115 mg milbemycin/lufenuron, 11.4 mg nitenpyram; For dogs 26–50 lb: 230 mg milbemycin/lufenuron, 57 mg nitenpyram; For dogs 51 to 100 lb: 460 mg milbemycin/lufenuron, 57 mg nitenpyram; For dogs100 to125 lb: (appropriate number supplied) milbemycin/lufenuron, 57 mg nitenpyram; *Sentinel® Flavor Tabs with Capstar®* (Novartis); (Rx). Approved for use in dogs and puppies 4 weeks of age or older.

HUMAN-APPROVED PRODUCTS: None

LYSINE
L-LYSINE

(***lye*-seen**)

NUTRITIONAL AMINO ACID

Prescriber Highlights

- Amino acid that may be effective in suppressing FHV-1 infections in cats
- Adverse effects unlikely if mixed with food
- Long-term treatment required

Uses/Indications

Lysine may be effective in suppressing FHV-1 infections in cats.

Pharmacology/Actions

Lysine is an amino acid that is thought to compete with arginine for incorporation into many herpes viruses. As it is believed that arginine is required for producing infective viral particles, when lysine is incorporated, the virus becomes less infective.

Pharmacokinetics

No specific information was located.

Contraindications/Precautions/Warnings

No specific contraindications.

Adverse Effects

Adverse effects are unlikely when mixed with food. Patients (human) taking lysine have occasionally complained of abdominal pain and diarrhea; one patient developing tubulointerstitial nephritis has been reported.

Reproductive/Nursing Safety

Lysine showed no teratogenic effects when given to pregnant rats, although safety has not been established in other species.

Overdosage/Acute Toxicity

Significant toxicity is unlikely. Gastrointestinal effects (nausea, vomiting, diarrhea) may occur.

Drug Interactions

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

- **ARGININE:** Arginine may negate the anti-herpesvirus effects of lysine
- **CALCIUM, ORAL:** Concomitant use with calcium supplements may increase calcium absorption from the gut and decrease calcium loss in the urine

Laboratory Considerations

No specific concerns noted

Doses

- **CATS:**

  To prevent or reduce recurrent feline herpesvirus ocular infections:

  a) 500 mg PO twice daily for life (Glaze 2002)
  b) 500 mg mixed with food daily (Nasisse 2002)
  c) 250 mg PO twice daily (Powell 2002), (August 2007)

  As adjunctive therapy for feline herpesvirus dermatologic infections:

  a) 250 mg PO twice daily (Griffies 2002)
  b) 250 mg PO once to twice daily (Boord 2002)

Monitoring

- No specific monitoring is required for lysine except those that would be required to monitor the herpes infection in the patient.

Client Information

- Lysine is easiest to administer by crushing tablets or emptying capsules and then mixing with food.
- Clients should understand that lysine does not cure the infection, but helps to control it (reduces the severity and frequency) and that lifetime therapy may be required.

- When purchasing, avoid products that contain propylene glycol.

Chemistry/Synonyms
An aliphatic amino acid, lysine has the chemical name L-2,6-diaminohexanoic acid and has a molecular weight of 146.2. It may be commercially available as the acetate or hydrochloride salts, or as the base.

Lysine may also be known as: L-lysine, L-*Lysine Powder-Pure*®, Lys, K, *Enisyl*®, *Incremin*®, and *Viralys*®.

Storage/Stability
Unless otherwise specified on the label, lysine should be stored at room temperature in tight containers.

Dosage Forms/Regulatory Status
VETERINARY-LABELED PRODUCTS:

Note: There are many products containing lysine as one of many ingredients. The following products were located with veterinary labeling where lysine is sole active ingredient:

L-lysine Gel: 250 mg per 1.25 mL: *Viralys® Gel* (Vet Solutions); (OTC). Labeled for use in cats and kittens.

L-lysine Powder: (in a palatable base) approximately 250 mg per rounded scoop: *Viralys® Powder* (Vet Solutions); (OTC). Labeled for use in cats and kittens.

L-Lysine Powder Feed Additive: in 16 oz. jars and 5 lb. pails; L-*Lysine Powder-Pure*® (AHC); (OTC) Labeled for use in horses.

HUMAN-LABELED PRODUCTS:

L-Lysine Tablets & Capsules: 312 mg, 334 mg, 500 mg & 1000 mg; *Enisyl*® (Person & Covey); generic; (OTC)

Lysine is considered a nutrient in the USA, therefore, it is exempt from FDA approval requirements. There are many products available including tablets and capsules that usually range in strengths from 250 mg to 1000 mg. Combination products are also available.

***Lysodren*® — see Mitotane**

Magnesium-containing Laxatives – see Saline/Hyperosmotic Laxatives; Magnesium Hydroxide

MAGNESIUM HYDROXIDE MAGNESIUM/ALUMINUM ANTACIDS

(mag-***nee***-zee-um hye-***droks***-ide)

ORAL ANTACID/LAXATIVE

Prescriber Highlights
- Used as a gastric antacid for ulcers, etc., but use largely supplanted by newer agents
- In ruminants, can be useful to increase rumen pH
- Magnesium salts contraindicated in patients with renal disease
- Magnesium salts may cause diarrhea
- Chronic use may lead to electrolyte abnormalities
- Many potential drug interactions

Uses/Indications
Magnesium hydroxide in combination with aluminum salts have been used in veterinary medicine for the adjunctive treatment of esophagitis, gastric hyperacidity, peptic ulcer and gastritis. In foals and small animals, because of difficulty in administration, the frequent dosing that is often required, and availability of the histamine-2 blocking agents (cimetidine, ranitidine, etc.), proton-pump inhibitors (*e.g.*, omeprazole) and sucralfate, antacids have largely been relegated to adjunctive roles in therapy for these indications. Magnesium hydroxide alone (milk of magnesia) is sometimes used as an oral laxative in small animals.

In ruminants, magnesium hydroxide is used to increase rumen pH and as a laxative in the treatment of rumen overload syndrome (*aka* acute rumen engorgement, rumen acidosis, grain overload, engorgement toxemia, rumen impaction).

Pharmacology/Actions
Oral antacids used in veterinary medicine are generally relatively non-absorbable salts of aluminum, calcium or magnesium. Up to 20% of an oral dose of magnesium can be absorbed, however. Antacids decrease HCl concentrations in the GI. One gram of these compounds generally neutralizes 20–35 mEq of acid (*in vitro*). Although the pH of the gastric fluid can rarely be brought to near-neutral conditions, at a pH of 3.3, 99% of all gastric acid is neutralized, thereby reducing gastric acid back-diffusion through the gastric mucosa and reducing the amount of acid presented to the duodenum. Pepsin proteolytic activity is reduced by raising the pH and can be minimized if the pH of the gastric contents can be increased to >4.

Contraindications/Precautions/Warnings
Magnesium-containing antacids are contraindicated in patients with renal disease. Some products have significant quantities of sodium or potassium and should be used cautiously in patients who should have these electrolytes restricted in their diet. Aluminum-containing antacids may inhibit gastric emptying; use cautiously in patients with gastric outlet obstruction.

Adverse Effects
In monogastric animals, the most common side effects of antacid therapy are constipation with aluminum- and calcium-containing antacids, and diarrhea or frequent loose stools with magnesium containing antacids. Many products contain both aluminum and magnesium salts in the attempt to balance the constipating and laxative actions of the other.

If the patient is receiving a low phosphate diet, hypophosphatemia can develop if the patient chronically receives aluminum antacids. Magnesium-containing antacids can cause hypermagnesemia in patients with severe renal insufficiency.

If administering calcium carbonate in high doses or chronically, significant quantities of calcium can be absorbed from the gut resulting in hypercalcemia in susceptible patients. Calcium carbonate has also been implicated in causing a gastric acid rebound phenomena. Patients with significant renal impairment or dehydration and electrolyte imbalance can develop the milk-alkali syndrome. If the patient is receiving a low phosphate diet, hypophosphatemia can develop if the patient chronically receives calcium carbonate antacids.

In ruminants, alkalinization of the rumen may enhance the absorption of ammonia, histamine or other basic compounds.