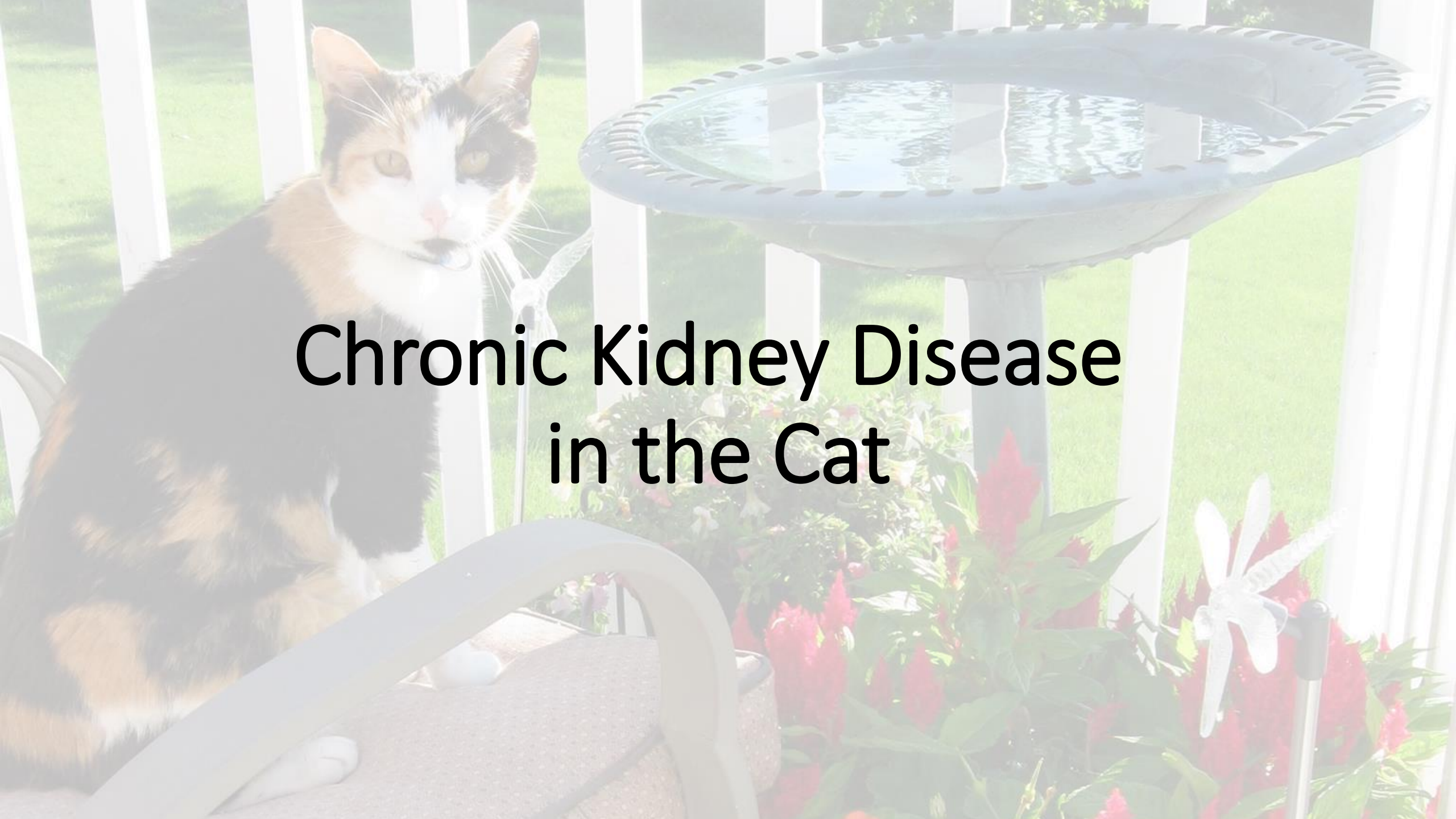


Chronic Kidney Disease in the Cat

Fairly Common Condition Seen in Older Cats

- **History**
- **Physical Exam**
- **Differential Diagnosis**
- **Diagnostics**
- **Staging**
- **Treatments**
- **Monitoring**

History

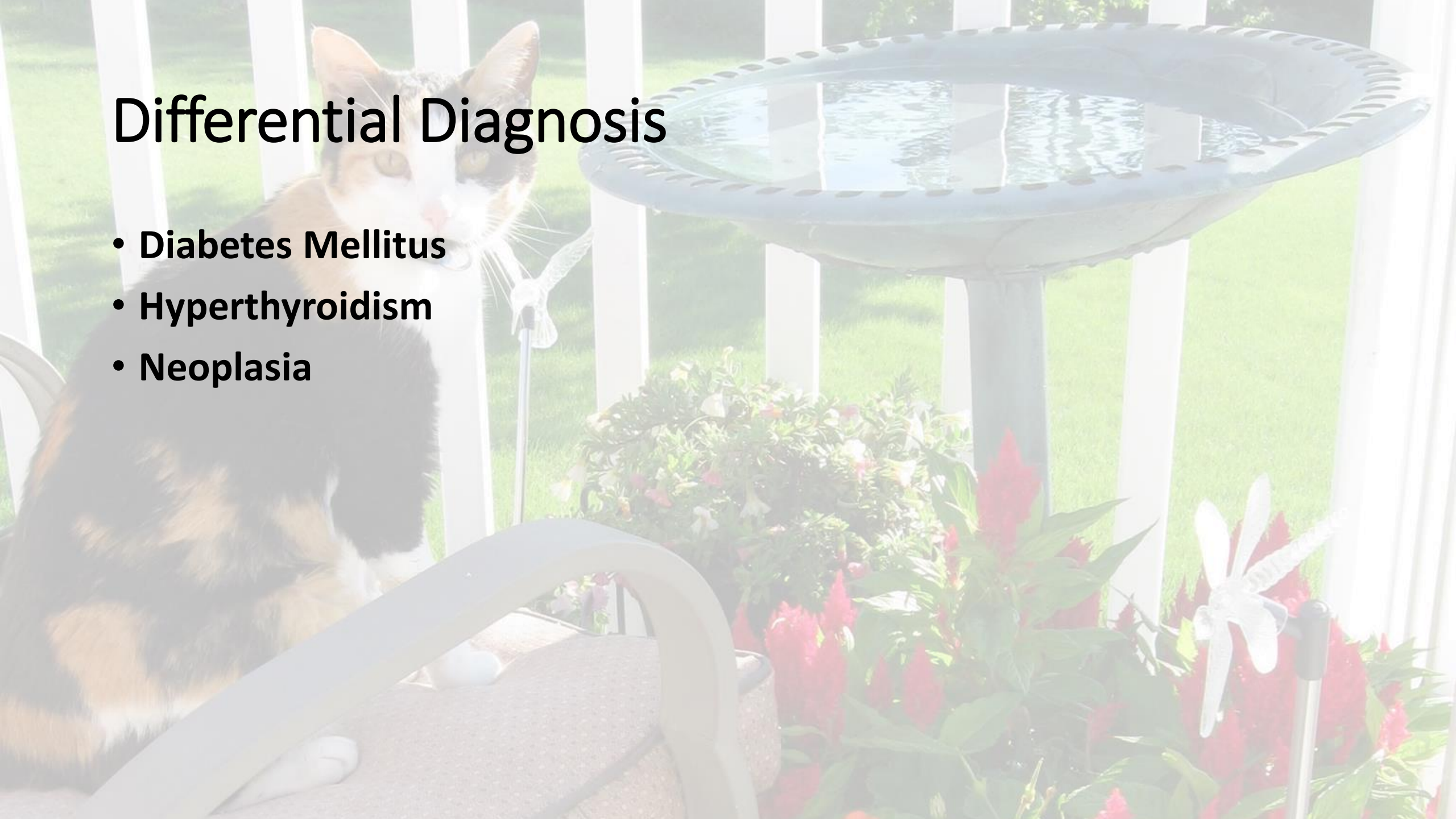
- **Polydipsia**
  - **Not always observed by owner**
  - **May see cat drinking in unusual places (sink, bath tub, toilet, birdbath, etc)**
  - **May be having to fill water dish more frequently (difficult to determine in multi-cat households)**
- **Polyuria**
  - **Larger amount of urine passed (owner finding large clumps in litter box)**
  - **Urinating in inappropriate places**
  - **Difficult to determine in cats that go outside or in multi-cat households**
- **Gradual weight Loss**
- **Others- lethargy, anorexia, vomiting, constipation, acute blindness**

Physical Exam

- **In early stages of disease may be normal**
- **In later stages of disease may see…**
  - **Poor hair coat**
  - **Thin body condition score (muscle wasting)**
  - **Dehydration (tacky mucus membranes, prolonged skin tent)**
  - **Pale pink mucus membranes (anemia)**
  - **Gingivitis, periodontal disease, halitosis**
  - **Small irregular kidneys**
  - **Retinal detachment or tortuous retinal vessels (hypertension)**

Differential Diagnosis

- **Diabetes Mellitus**
- **Hyperthyroidism**
- **Neoplasia**



Diagnostics

- **Urinalysis**
  - **Specific gravity (USG) < 1.035 (recheck after withholding water overnight unless kidney values are elevated). Over 2/3 of functional renal mass must be lost before the kidneys lose their ability to concentrate urine.**
  - **May see proteinuria- check urine protein:creatinine ratio (UPC) IF inactive urine**
  - **May see urinary tract infection- more likely with dilute urine, especially in female cats**
- **CBC**
  - **Anemia due to insufficient renal erythropoetin production (normocytic, normochromic and poorly regenerative)**

- **Chemistry Panel**
  - **Azotemia- increased blood urea nitrogen (BUN) and creatinine (CR)-Cr is a more reliable, but isn't increased until 75% of kidney function is lost**
  - **Symmetric dimethylarginine (SDMA)- increased with as little as 25% loss of kidney function**
  - **Decreased potassium(K)**
  - **Increased phosphorus (P)**
  - **Decreased calcium (Ca)**
  - **Decreased bicarbonate (acidosis)**
  - **Total T4- normal. If increased (hyperthyroidism) can be masking underlying renal disease**
- **Systolic Blood Pressure (SBP)**
  - **Must be performed in a quiet, controlled environment (dark room, allow time to become adjusted, towel sprayed with feline pheromone)**

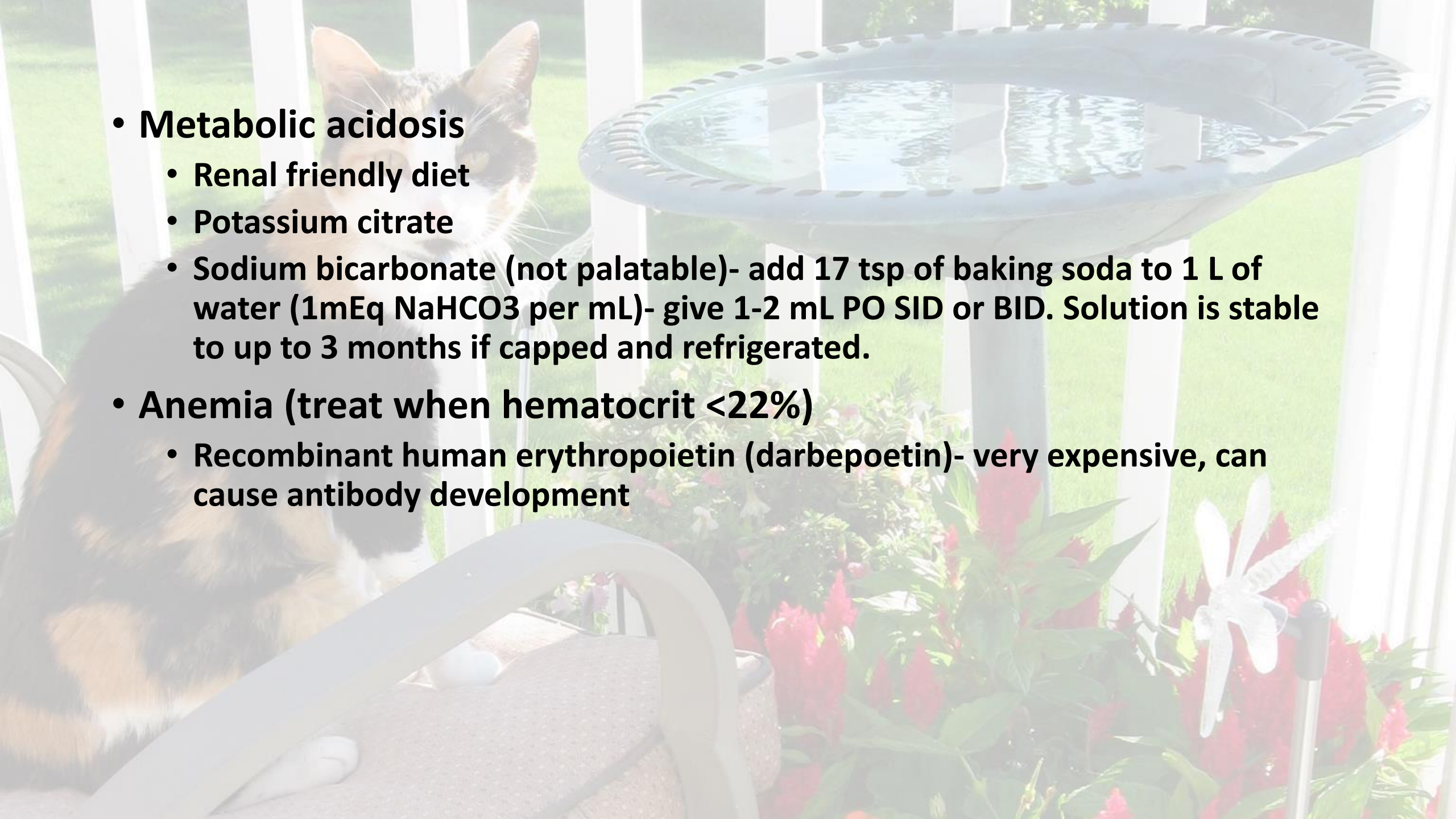
Staging by International renal Interest Society (IRIS) www.iris-kidney.com

- **Staging based on creatinine (mg/dL) and SDMA (mcg/dL)**
  - **Stage 1 Cr<1.6, SDMA<18**
  - **Stage 2 Cr=1.6-2.8, SDMA=18-25**
  - **Stage 3 Cr=2.9-5.0, SDMA=26-38**
  - **Stage 4 Cr>5, SDMA>38**
- **Substaging by proteinuria**
  - **UPC<0.2 Non-proteinuric**
  - **UPC=0.2-0.4 Borderline proteinuric**
  - **UPC>0.4 Proteinuric**
- **Substaging by blood pressure**
  - **<140 Normotensive**
  - **140-159 Prehypertensive**
  - **160-179 Hypertensive**
  - **>180 Severely hypertensive**

Treatment

- **USG <1.035, SDMA >14 mcg/dL, Cr >1.6 mg/dL**
  - **Start renal diet-restricted in protein, phosphorus and sodium; supplemented with potassium, omega-3 fatty acids, B vitamins and fat content; alkalinizing**
- **UPC >0.4**
  - **Benazepril 0.5-1.0 mg/kg (1/2 of 5 mg tablet) PO SID**
- **SBP >160**
  - **Amlodipine 0.18 mg/kg (1/4 of 2.5 mg tablet) PO SID- recheck BP in 7 days**
- **Dehydration/constipation**
  - **Constant fresh water supply (water fountain, dripping faucet), canned food**
  - **Subcutaneous (SC) fluids- can give up to 100 mL/cat/day divided over 4 areas**
  - **Psyllium husk, probiotics**

- Anorexia
  - Mirtazapine 1.88 mg PO (or transdermal) (1/4 of 7.5 mg tablet) q 1-2 days
  - Esophagostomy tube
- Vomiting
  - Maropitant 2 mg/kg sid for up to 5 days, then 2 day break
- Hyperphosphatemia
  - Renal friendly diet
  - Phosphate binding agents- unknown added benefit
- Hypokalemia
  - Renal friendly diet
  - Potassium gluconate 2-6 mEq/cat/day divided q8-12h
  - Potassium citrate 40-60 mg/kg/day divided q8-12h (potential benefit of alkalinization)



- **Metabolic acidosis**
  - **Renal friendly diet**
  - **Potassium citrate**
  - **Sodium bicarbonate (not palatable)- add 17 tsp of baking soda to 1 L of water (1mEq $NaHCO_3$ per mL)- give 1-2 mL PO SID or BID. Solution is stable to up to 3 months if capped and refrigerated.**
- **Anemia (treat when hematocrit <22%)**
  - **Recombinant human erythropoietin (darbepoetin)- very expensive, can cause antibody development**

Monitoring

- **Once stabilized, every 3-6 months depending on stage of CKD**
- **Physical exam- check weight and hydration, oral exam**
- **CBC/Chem Panel/T4**
- **UA with UPC (culture as needed)**
- **BP**
- **Chart for owners**

RENAL HEALTH TESTS (for chronic kidney disease-CKD))

BLOOD TESTS

Blood Urea Nitrogen (BUN)-This is a product of the breakdown of ammonia. Increases in this value are seen with high protein diets, muscle wasting, and kidney disease. A buildup of this substance is toxic and leads to clinical signs of illness (when ¾ of the total kidney mass is nonfunctional).

Creatinine (Cr)-This is produced in muscle. It is a better indicator of renal function than BUN. A buildup of this substance is toxic and leads to clinical signs of illness (when ¾ of the total kidney mass is nonfunctional).

Symmetric dimethylarginine (SDMA)- Increased with as little as 25% loss of kidney function

Electrolytes

1. Potassium (K)-The kidney is the main site in the body for potassium regulation. CRI leads to a decrease in the level of potassium.

2. Phosphorus (P)-CRI leads to an increase in the level of phosphorus.

3. Calcium (Ca)-An increase in phosphorus causes a decrease in calcium, which signals the body to pull more calcium out of the bones.

4. Bicarbonate (bicarb)-CRI can cause a metabolic acidosis (pH of the blood is too low). This causes a breakdown of the muscle which contributes to the buildup of toxins, and further lowers the level of potassium.

Hematocrit (HCT)-This value is used to determine the degree (if any) of anemia present. CRI decreases the amount of erythropoietin which is needed to stimulate the production of red blood cells (the oxygen carrying cells in the blood).

URINE TESTS

Specific Gravity (SG)-This measures the kidney's ability to concentrate urine (reabsorb water). The ability to concentrate urine is lost when ⅔ of the total kidney mass is nonfunctional. At any given time of the day, cat urine normally has a SG over 1.040. There is minimal concentration at a value under 1.035, and no concentration between the values of 1.008-1.012.

Urine Protein:Creatinine Ratio (UPC)- This measures the amount of protein leaking through the kidneys. Increased urinary protein concentrations lead to further kidney injury.

Urine White Blood Cell (WBC) Count and/or Culture- These are used to detect a urinary tract infection (UTI). Concentrated urine is a good defense against UTI's. When the concentrating ability is lost, UTI's are more prevalent.

OTHER TESTS

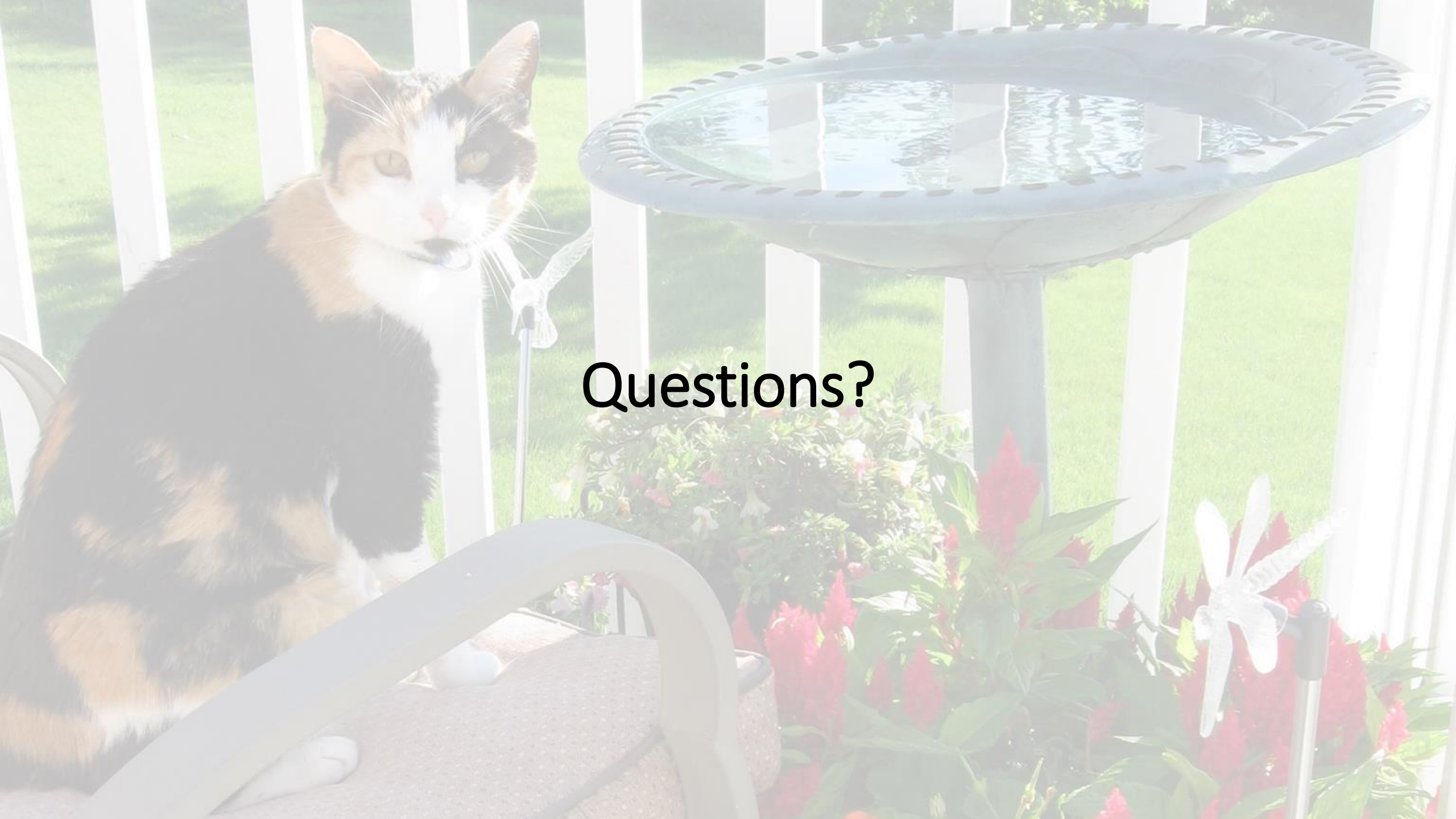
Physical Exam/Daily Monitoring (PE)-A physical exam is important to assess general health and hydration status. Daily monitoring of appetite, water intake, urine output, and any vomiting is important to be able to maintain good hydration and body weight.

Weight (WT)-CRI can decrease body mass, and the buildup of toxic substances leads to anorexia.

Systolic Blood Pressure (SBP)-CKD and hyperthyroidism are the most common disease conditions associated with hypertension (high blood pressure) in cats. Hypertension can cause blindness and cardiac disease if not treated.

Chewby Cashman- Renal Health Checks

Date	Wt.	BUN (13-36)	Cr (0.6-2.1)	P (2.7-7.3)	Ca (8.1-11.8)	K (3.4-5.4)	Bicarb (11-21)	Hct (28-47)	SG >1.030	UPC <0.4	BP <160	Treatments
8/7/15	8.7	**37**	**2.2**	4.5	9.7	3.7	15	33.2	**1.016**	0.103	**170**	PD k/d Amlodipine 0.625 mg
8/28/15	8.5										105	PD k/d Amlodipine 0.625 mg
11/23/15	7.8	20	1.7	4.3	9.5	3.9	16	31.8			**170**	PD k/d Amlodipine 1.25 mg
12/7/15	7.7										127	
3/7/16	7.7										105	
7/27/16	7.5	24	2.0	3.4	10.4	3.7	17	35.1	**1.016**			
8/22/16	7.6										145	
2/27/17	8.1	27	1.8	4.1	10.1	3.9	16	32.7	**1.019**	0.100	146	
8/9/17	6.6	26	1.9	3.5	9.7	3.7	14	32.0	**1.017**	0.090	158	
3/21/18	7.3	19	1.8	4.4	11.0	3.6	18	28.6				PD k/d Amlodipine 1.25 mg Dasuquin Gabapentin SC fluids
6/20/18	7	19	1.7									
7/20/18		18	1.6	3.5	10.0	**3.1**	18	28.7	**1.015**		146	
1/9/19	5.9	17	1.4	3.7	9.9	3.6	17	29.3	1.015		138	
3/18/18	6	24	1.6									


Questions?