I. Normal anatomy/physiology; vocabulary terms
   A. Upper respiratory tract
      a. Cere
      b. Nares
      c. Operculum
      d. Birds have an incomplete hard palate with a median fissure
         i. Choanae (internal nares)
         ii. Choanal slit
         iii. Choanal papillae
         iv. Infundibular cleft
      e. Birds have one paranasal sinus: infraorbital sinus (IOS)
      f. The IOS has diverticula
      g. The upper airway is relatively unprotected
         i. Glottis
         ii. No epiglottis
   B. Trachea
      a. Complete, overlapping rings
      b. Long and flexible
      c. Large diameter
      d. Syrinx: the site of vocal production
         i. Distal trachea
         ii. Modified cartilages and muscles
      e. Bifurcates in primary bronchus, secondary bronchi and then parabronchi within lung
   C. Lower respiratory tract
      a. The avian lungs are located dorsally, fixed in place
      b. The air capillary off atria of parabronchi; analogous to the alveolus
      c. The air sacs serve as bellows
   D. Respiration
      a. Low respiratory rate and minimally visible is normal
      b. Two breath cycle: Inspiration > Expiration > Inspiration > Expiration
      c. Unidirectional air flow
      d. Cross current blood flow
      e. Gas exchange in parabronchi, atria and air capillary
         i. Best in air capillary
         ii. Blood-gas barrier thinner
         iii. Smaller diameter of air capillary
         iv. Greater density of air capillary to alveoli

II. Clinical signs of respiratory disease; Five areas for diseases
   A. Upper respiratory disease (infection, allergy, foreign body, tumor)
      a. Open-mouthed breathing without dyspnea
      b. Nasal discharge
      c. Abnormal beak with chronic disease (groove, etc)
      d. Abnormal shape of naris
      e. Nasal plug
      f. Facial swelling
B. Large airway disease (granuloma, foreign body, thyroid)
   a. History of voice change
   b. Exaggerated respiratory click
   c. Open-mouthed breathing
   d. Increased expiratory effort
   e. Wet, sputtering sounds
C. Small airway disease (inhaled toxins, smoke, asthma)
   a. Open-mouthed breathing
   b. Wide-based stance, wings abducted
   c. Expiratory squeak
D. Pulmonary parenchymal disease (lungs and air sacs)
   a. Nebulous signs; quiet, poor appetite, decreased activity
   b. Increased respiratory rate and effort
   c. Mild to moderate tail-bob
   d. Not usually open-mouthed breathing
E. Coelomic disease (ascites, egg, mass)
   a. Loss of air sac volume
   b. Tachypnea
   c. Short, shallow respirations

III. Emergent treatment of respiratory disease
A. Move to warm oxygen cage immediately; allow time to rest before treatment if possible
B. During movement to oxygen cage; brief physical examination
   a. Palpate abdomen for mass, fluid
   b. Palpate keel for body condition
   c. Palpate crop for presence of food/liquid
   d. Assess hydration
C. Treatment of upper respiratory disease
   a. Remove any nasal plugs
   b. Cytology of plug and discharge
   c. Nasal flush
   d. Topical and systemic treatments may be warranted
D. Treatment of large airway disease
   a. Terbutaline 0.1mg/kg IM may help
   b. Air sac cannula may be needed
      i. Anesthetize bird if possible
      ii. Place on right side, caudal to ribs, cranial to thigh, just below vertebrae
      iii. Use tracheal tube or red rubber tube
      iv. Suture into place with purse-string and finger knot
E. Treatment of small airway disease
   a. Terbutaline 0.1mg/kg IM
   b. Diphenhydramine 1-2mg/kg IM
   c. Nebulize and ventilate with terbutaline for inhaled toxin
F. Treatment of coelomic disease
   a. Remove fluid if present (cytology/culture)
   b. Keep quiet and avoid stress
   c. Remove egg if present

IV. Diseases of the respiratory tract
A. Nares, nasal cavity
   a. Foreign body
      i. Clear to mucopurulent discharge
      ii. Remove with flushing
      iii. Endoscopy or biopsy
   b. Rhinoliths or nasal granuloma
      i. Malnutrition, air quality, low humidity play roles
      ii. Wheezing, sneezing, discharge
iii. Debride and remove material  
iv. Submit for cytology/culture  
v. Topical and systemic treatment  
c. Rhinitis  
  i. Infection, allergy, irritation  
  ii. Discharge reflects cause  
  iii. Environmental factors can play role: dust, low humidity, smoke, aromatic oils  
iv. Bacteria include: Klebsiella, Pseudomonas, E. coli, Enterobacter, Mycoplasma (small birds), Chlamydophila.  
v. Aspergillosis in some species  
vi. Culture, flush, systemic and topical treatment  
d. Infraorbital sinus  
  i. Infection, hypovitaminosis A  
  ii. Caseous exudate difficult to remove  
  iii. Surgical debridement may be needed  

B. Trachea  
a. Tracheitis  
  i. Bacteria; gram negative, Staphylococcus, Streptococcus  
  ii. Fungal; aspergillosis most common  
  iii. Viral; uncommon in pet birds  
  iv. Granulomas form at bifurcation  
v. Radiographs and endoscopy helpful for diagnosis and removal  
b. Foreign body  
  i. Aspiration of small material  
  ii. Usually obstruct at level of bifurcation  
  iii. Visible radiographically or via endoscopy  
  iv. Removal with endoscopy or tracheotomy  
c. Other disease  
  i. Bite wound and infection; cat, dog, bird  
  ii. Trauma during flight (wild birds)  
  iii. Thyroid mass  

C. Lungs and air sacs  
a. Neoplasia  
  i. Uncommon  
  ii. Primary: adenoma, carcinoma, bronchial carcinoma  
b. Asthma  
  i. Common in macaws  
  ii. History of environmental contaminants  
  iii. Quick response to terbutaline and diphenhydramine  
c. Infectious disease  
  i. Bacteria typically gram negative  
  ii. Chlamydiophila will have other signs with air sacculitis  
  iii. Viral diseases less common in pet birds (pox, paramyxovirus)  
  iv. Parasitic infections in outdoor birds (Sarcocystis, Syngamus, Sternosoma)  
d. Aspiration pneumonia  
  i. Caudal lungs and air sacs (radiographs)  
  ii. Food and fluid can cause  
  iii. History of hand-feeding, vomiting, etc  
e. Toxins  
  i. Very sensitive due to physiology  
  ii. Smoke, CO, CO2, aromatic chemicals, teflon  
  iii. Acute onset pulmonary edema, hemorrhage  
  iv. Chronic pneumoconiosis can occur  

d. Coelomic disease  
a. Fluid accumulation  
  i. Transudate: liver disease, hypoproteinemia, inflammation, neoplasia
ii. Exudate: egg-yolk peritonitis, infection, neoplasia  
iii. Remove fluid for respiratory comfort and cytology  
iv. Ultrasound helpful diagnostically  
   a. Fluid in different compartments depending on cause