GENERAL PRINCIPLES

A. Notable Anatomic / Physiologic Differences (birds vs mammals)

1. Integument: feathers, scales, beak, claws / spurs (weapon of choice for poultry), uropygial gland.
2. Respiratory: fixed nares, choanal slit, glottis closes side-to-side (no epiglottis), complete tracheal rings (can’t use cuffed trach tubes for anesthesia), syrinx at bifurcation of 1st bronchi responsible for vocalization, non-expanding lungs with flow through air capillaries (gas exchange takes place on inspiration and expiration – more efficient than mammals), multiple bilateral airsacs pull and push air through lungs, no diaphragm.
3. Gastrointestinal: beak (no teeth), crop (outpouching of esophagus for food storage, proventriculus (glandular stomach), ventriculus (grinding stomach), ceca (bilateral), colorectum (no colon), cloaca (GI, urinary, repro and bursa of Fabricius all open into this cavity).
4. Circulatory: 2 portal systems hepatic and renal (latter is reason why drugs given in leg muscle are likely to be cleared before entering systemic circulation – therefore must inject in breast or give PO).
5. Hematological: nucleated RBC, neutrophils are referred to as heterophils (do not possess liquefactive enzymes – therefore birds caseate instead of form pus), nucleated thrombocytes instead of platelets.
6. Renal: excrete nitrogenous waste in form of uric acid (renal failure results in build-up of uric acid in blood – and deposition in other tissues), excrete small amount of water, peristaltic ureters, no bladder.
7. Immunological: bursa of Fabricius (opens into dorsal cloaca), thymus – bilateral chains adjacent to jugular along neck (outside thoracic inlet), no lymph nodes, do have mucosa associated lymphoid tissue, cecal tonsils.
8. Reproductive: reproduction is brought on by increasing day length and light intensity as well as food availability, female - only left ovary and oviduct mature, oviduct is term used to describe entire tubular portion of repro tract – different portions of egg are added as ovum moves through oviduct, shell is added in uterine portion of oviduct, sperm glands used in female to store sperm for up to 14 days, chickens and turkeys are indeterminate layers (if you remove egg they will lay another); male – bilateral internal testes, sperm maturation takes place at night when body temp drops.
9. Musculoskeletal: bones adapted for flight i.e., coracoid, some communicate directly with airsacs and are air filled e.g., humerus, vertebrae, many bone are fused e.g., synsacrum (last lumbar vert + sacral vert + pelvic bones + first few coccygeal vert), pygostyle – tail bone, tibiotarsus, tarsometatarsus, carpometacarpus.
10. CNS / Special Senses – Few gyri and sulci, large eye with scleral ossicle (to help maintain shape), plicate membrane to help maintain intraocular pressure (eye will begin to collapse if blood pressure drops), large optic lobes – ventral brain.

B. Clinical Signs are the outward manifestations are the result of alterations in normal anatomy and physiology. General “sick bird” signs include: depression, huddling, ruffled feathers, decreased food and water consumption, decreased activity, seclusion, weight loss (seen most prominently in breast muscle but often hidden by feathering, decrease or cessation of egg production (lack of weight gain), pecking by pen mates (sick birds are on bottom of pecking order).
MAJOR DISORDERS OF POULTRY

A. Respiratory

1. **PMV-1 Infection / Newcastle Disease** are caused by a Paramyxovirus. They affect chickens, turkeys, and most other types of birds. There are extremely nasty ("hot") strains typically not found in the US and milder strains that are common here. The "hot" strains are something that we constantly look out for because when they are found (most recently in CA, 2002-2003), they generally cause devastating losses and major disruptions in national and international trade. The hot strains are often referred to as "Exotic Newcastle Disease" (OIE /WAHO refers to them just as Newcastle Disease; milder strains being referred to as PMV-1). With the "hot" strains the most distinctive clinical signs and lesions include: swelling around the eyes, hemorrhages under the skin and swelling of the combs and wattles, hemorrhages in the upper respiratory and GI tracts. The disease moves fast, with high morbidity and high mortality. In fact, the high mortality is a hallmark. This form of Newcastle Disease needs to be confirmed by a veterinary diagnostic lab and is reportable at both the State and Federal levels. The mild strains of (PMV-1) typically produce respiratory signs like sneezing, discharge from the nose, and slight swelling around the eyes. These infections can become complicated with secondary bacterial pathogens so we try to prevent them by vaccinating. The vaccine for chickens is usually administered in combination with IB virus. A mild strain, B1 or LaSo i.e., Clonevac 30T is used to vaccinate turkeys. Mild forms of the disease (PMV-1) are not reportable. Like most viral diseases, there is no treatment. Birds infected with the "hot" strain are destroyed. Those that get the mild strains are sometimes treated with antibiotics to ward off secondary bacterial infections. People can develop mild conjunctivitis following exposure to PMV-1 field or vaccine isolates.

2. **Avian Influenza (AI)** is caused by an Orthomyxovirus. It affects chickens, turkeys and many other bird species. In particular, ducks and geese are thought to serve as a reservoir for this virus. Like Newcastle Disease, there are "high pathogenic" strains (HPAI) and "low pathogenic" strains (LPAI). Generally speaking, the clinical signs and lesions seen with HPAI aren't too different from those of exotic Newcastle disease. The disease moves fast, with high morbidity. The mortality you see depends on the strain of the virus. With HPAI, it is typically very high (>50%, per-acute/acute onset). LPAI strains cause mild upper respiratory disease that can become complicated with secondary bacterial infections. HPAI and LPAI (H5/H7 strains) are reportable at the State and Federal levels (typing done at NVSL). Infection should be confirmed by a veterinary diagnostic facility (NAHNL). Other H serotypes may elicit State intervention i.e., H1 or H3 due to possible impact on swine. Like Newcastle disease, there are trade implications with both HPAI and LPAI (H5/H7). There's no treatment for HPAI or LPAI (H7 and H5 strain). Strains of LPAI other than H5/H7 can be vaccinated for by special permission of the USDA. If a non H5/H7 infection is diagnosed, antibiotics may be used to prevent secondary bacterial infections from developing and controlled marketing used to salvage flock. In the US, we try to get rid of HPAI by destroying all affected birds (50 Million birds in the 2015 mid-west outbreak). Currently, we also use eradication to deal with certain strains of LPAI e.g., H5/H7 strains. That's because there is a fear that these strains will mutate into the HPAI. Recent outbreaks of HPAI ("Avian Flu") in Asia, Middle East, Africa and the Netherlands have also been linked to human illness.

3. **Infectious Bronchitis (IB)** is caused by a coronavirus. It is primarily a chicken disease. The predominant clinical signs and lesions include sneezing, coughing, inflammation and mild hemorrhage in the trachea. The virus can also infect the reproductive tract and kidneys. Misshapen (wrinkled) eggs and a drop in egg production are often seen. The disease moves fairly fast, with high morbidity, and low to moderate mortality. There's no treatment for IB. We commonly vaccinate chickens for this disease at the same time that we vaccinate for the mild forms of Newcastle (PMV-1).
4. **Infectious Laryngotracheitis** (ILT) is caused by a Herpes virus. It affects chickens. The predominant clinical signs coughing and bloody discharge form the nostrils. Hemorrhage in the trachea is often observed and can be severe enough the birds will actually cough up blood. In severe infections, the lining of the trachea will slough and plug to airway so that birds suffocate. This infection moves slowly through a flock of chickens, but the morbidity is usually high and mortality low to moderate. There’s no treatment for ILT. Vaccines (typically “tissue culture origin”, TCO as opposed to Chick Embryo Origin, CEO) are used regionally when there is an increased occurrence of the disease. There are some trade implications with this disease, notably with Russia and Japan, so many States consider it reportable (always best to call this one in).

5. **Infectious Coryza** is a bacterial disease that primarily affects layer chickens (commercial and backyard flocks) most commonly in colder, wetter months. It is caused by *Avibacterium paragallinarum*. The predominant clinical signs are oculonasal discharge, swelling of the head, especially sinuses, and an unusual odor (smells like an infected dog’s ear – otitis externa). Morbidity is often high, but mortality is low. The most commonly used treatment is Gallimycin (erythromycin, feed or water – likely to be pulled from the market soon). There is a vaccine for IC that is used on farms where the disease has become endemic. This is because most layer operations constantly have new pullets coming onto the farm and IC, even with treatment, is never completely eliminated i.e., recovered birds may become carriers.

6. **Mycoplasmosis** is a bacterial disease that affects chickens, turkeys, and some other bird species. There are three species of the organism seen commonly in the field: *Mycoplasma gallisepticum* (MG), *Mycoplasma synoviae* (MS), and *Mycoplasma meleagridis* (MM). Clinical signs include sneezing, coughing, swelling of the sinuses (MG in turkeys), and inflammation of the airsacs (airsacculitis). The disease is worsened by involvement of other bacteria like *E. coli*. Antibiotics (Tylan) can be used to treat this disease but sometimes the birds become chronic shedders of the organism. Some will also have reoccurring bouts of the disease. This latter form is known as CRD or Chronic Respiratory Disease. CRD is common in cock-fighting circles because birds often look healthy but are shedding the organism and mingling with other susceptible birds at the “pits”. Also common in backyard flocks do to “trading” or purchasing of birds from other backyard operations. Commercial operations rarely vaccinate for MG. They will typically destroy infected birds but killed vaccines are available. In many states MG is reportable and permission may be required for vaccination.

7. **Fowl Cholera** is caused by the bacterium *Pasteurella multocida*. It can affect both chickens and turkeys. Typically older birds are affected. The primary clinical signs and lesions include difficulty breathing, coughing cyanosis of the head, pneumonia, swelling of the liver and spleen. The disease can move quickly through a flock, with high morbidity and moderate mortality. The organism can be easily cultured from affected organs. Antibiotics (Penicillin, Aureomycin) can be used to treat this disease. Rats may also become infected and then serve as a reservoir for infection on a farm. There are live and killed vaccine available for Fowl Cholera.

8. **Colibacillosis** is caused by *Escherichia coli* (E. coli). It usually occurs secondary to some other infection like PMV-1 or bordetellosis. It is the no. 1 disease diagnosis made in commercial operations, but predisposing agents are the “real cause”. The clinical signs and lesions include difficulty breathing, sneezing, coughing, pneumonia, airsacculitis, inflammation around the heart (pericarditis), swelling and inflammation of the liver (hepatomegaly / hepatitis), fibrin deposition on the surface of the liver (perihepatitis), swelling of the spleen (splenomegaly). The lesions result from the bacterium being widely disseminated through the blood. The disease can develop quickly in a flock with high morbidity and moderate mortality if untreated. Antibiotics can be used to treat this disease, but the best thing to do is prevent the primary insult(s) from occurring. Here’s where good diagnostics and a vaccination program really help.
9. **Bordetellosis** is a bacterial disease caused by *Bordetella avium*. It primarily affects young turkeys. The clinical signs and lesions include difficulty breathing, discharge from the nose and eyes, inflammation and sloughing of the tracheal lining, and tracheal collapse. The disease moves quickly through a flock with high morbidity and moderate mortality if untreated. Antibiotics are not very useful in treating this disease because it is difficult to get high enough levels at the surface of the trachea where the infection is occurring. The best treatment is to increase the environmental temperature and improve the air quality. Sometimes antibiotics are helpful in preventing another bacterium like *E. coli* from setting up a secondary infection. A live *Bordetella* vaccine (ArtVax, originally organism was called *Alcaligenes rhinotracheale*) is available.

10. **Aspergillosis** is a fungal disease caused by *Aspergillus fumigatus* and *Aspergillus flavus*. These are environmental contaminants. Newly hatched chicks and poults can inhale fungal spores that are released when an egg explodes in a mechanical hatcher. Older birds can inhale the spores from moldy feed or litter material (substrates need to go through wet and dry phases). The clinical signs and lesions include difficulty breathing, small white-yellow nodules in the lungs, and green-white mold colonies on the airsacs. Treatment is not cost effective. Therefore the best thing to do is to pull dead embryos from incubator/hatcher and not use feed or litter material that is wet or moldy to start with. Provide good air circulation especially as birds get older and mold levels increase naturally in the litter.

11. **GaseousToxins** are extremely hard on birds. That is because their respiratory systems are extremely efficient. They quickly concentrate things like carbon monoxide, carbon dioxide, and methane. Levels that will barely affect a human are lethal for birds. High mortality without any history of disease is usually a good indication of some type of mechanical failure (brooding ovens, ventilation system) and subsequent gas build-up.

**B. Gastrointestinal**

1. **Viral Enteritis** is a common disease of young chickens and turkeys. There are many different types of viruses that can cause gastrointestinal problems. Astroviruses, coronaviruses, enteroviruses, reoviruses, rotaviruses are some of the more common ones. These viruses infect and subsequently destroy the cells lining the intestinal tract. The morbidity with such infections is high, but the mortality can vary dramatically depending on the virus. The most prominent clinical sign is diarrhea. Failure to thrive, stunting or delayed growth are typically observed.

2. **Hemorrhagic enteritis** (HE) is a viral disease of turkeys that affects both the gastrointestinal tract and the immune system. It is caused by a Siadenovirus. Morbidity is high and mortality is moderate with “hot” strains. Gastrointestinal bleeding and enlargement and mottling (white spots) of the spleen are the most prominent clinical signs and lesions. Because the virus infects and destroys cells in the immune system, secondary bacterial infections are common. Antibiotics may therefore be helpful to reduce mortality. Vaccines for HE are available.

3. **Necrotic Enteritis** is a bacterial disease of young chickens and turkeys. It is caused by *Clostridium perfringens*. Morbidity is moderate but among those birds that are affected, mortality can be high if the disease is untreated. Clinical signs and lesions include diarrhea, unthriftiness, and a rough/thickened appearance to the lining of the intestine. The treatment of choice for this disease is Bacitracin.

4. **Salmonellosis** is caused by numerous bacteria of the genus *Salmonella*. Some of these organisms like *S. pullorum* and *S. gallinarum* cause significant problems in young birds whereas others like *S. enterica* ssp *enterica* sva Typhimurium and *S.e.e. sv Enteriditis* (paratyphoids) cause little or no clinical disease in birds, but are a threat to the humans that consume them. Because *S. pullorum* and *S. gallinarum* cause disease in young birds, testing and eradication programs are in place to
eliminate these pathogens from breeder flocks. These efforts are the major focus of the National Poultry Improvement Plan (NPIP). Similar efforts are underway to detect and minimize the presence of other Salmonellas because of the risk they pose to the human food supply. Clinical signs in infected birds may range from diarrhea and high mortality to no apparent disease at all. Salmonellosis can be treated with antibiotics, but birds will often continue to shed the organism.

5. **Avian Tuberculosis** is a chronic bacterial disease caused by *Mycobacterium avium* ssp *avium* (Maa). Although the organism can infect any age of bird, the disease doesn’t show up until they are older. The granulomatous lesions develop very slowly and can involve the gastrointestinal tract, liver, kidneys and any other organ, but are most commonly GI associated. Gradual wasting is the hallmark clinical sign. Feathering tends to obscure the weight loss so unless owners are regularly picking birds up, they won’t notice the loss of muscle mass. Occasionally, diarrhea will develop because of the intestinal tract’s decreased absorptive capacity. There is no effective treatment. This organism has the potential to infect humans especially those who are young, old or immunocompromised. There are no treatment recommendations due to potential zoonosis. Small flock depopulation is the best approach and moving the coop to a different area due to heavy soil contamination.

6. **Candidiasis** (aka Sour Crop, Crop Mycosis) is caused by *Candida albicans* and is a common sequela to overuse of water administered antibiotics. Often, flock owners / producers will have attempted to use a product available through a feed/seed supply store or purchased off the web before they seek veterinary advice. The VFD should help this, but even properly administered products given under the direction of a veterinarian can promote yeast overgrowth in the GI tract. There are no labeled treatments for this in birds, copper sulfate (labeled for poultry) in the drinking water has some marginal benefit. Probiotics (Direct Fed Microbial, DFM) are also helpful. For the individual patient, Nystatin pediatric suspension (used for treating thrush in babies) can be prescribed from a local pharmacy (1 cc/ 300 g body weight BID x 7d). This should be given along with a probiotic (also obtainable from local pharmacy for individual oral dose, 1 cap/pill SID x 7 d).

7. **Coccidiosis** is a parasitic disease of chickens and turkeys caused by protozoa of the genus *Eimeria*. The organism replicates in intestinal epithelium eventually destroying these cells. Morbidity and mortality can both be high. Clinical signs include ill thrift, poor feed conversion and diarrhea, sometimes bloody. Lesions include bleeding in the GI tract and areas of tissue death. The location in the GI tract for these lesions depends on the species of the organism. Treatment can be accomplished by using drugs like Amprolium, but Coccidiosis is best prevented by incorporating a coccidiostat like Monensin (Coban) into the diet. Alternatively birds can be raised on wire (off the ground).

8. **Blackhead or Histomoniasis** is caused by the protozoan parasite, *Histomonas meleagridis*. The life cycle includes both the cecal worm (*Heterakis*) and occasionally earthworms as a transport host. The disease is generally mild in chickens which can be asymptomatic carriers. However, it causes high mortality in turkeys. For this reason chickens and turkeys should not be raised together. Affected turkeys appear “droopy” and have mustard yellow droppings/diarrhea. Pathognomonic findings include bulls-eye lesions in the liver and grossly enlarged, casedated ceca. Birds not destined for consumption can be treated with Metranidazole (PO, 20 mg / kg BID x 10 d, extra-label use). This is only justifiable to save genetic stock i.e., a heritage breed turkey trio (usually how backyard breeder turkeys are kept: 1 tom, 2 hens). However, there is no treatment for birds destined for consumption. Flocks can be salvaged by early marketing. Deworming with fenbendazole may reduce exposure by interrupting the cecal worm life cycle.

9. **Other Gastrointestinal Parasites** include nematodes (Roundworms - *Ascaridia*, Threadworms - *Capillaria*, *Heterakis* - cecal worm), Cestodes (Tapeworms), and Trematodes (Flukes -
uncommon). Ill-thrift is the most common clinical sign associated with these infections. Standard fecal flotation works for diagnosis (or post-mortem exam). The best treatments for nematodes include fenbendazole or hygromycin-B (piperazine is widely available but only moderately effective). For tapeworms, fenbendazole (marginally effective) and praziquantel (effective but not approved for poultry). Ivermectin is not approved for use in poultry but some will use for birds not destined for consumption to treat a variety of parasites (internal and external, at 200ug/kg BW). Deworming is recommended 2x / yr for birds raised on soil. Objective is to just keep the worm burden low.

10. **Nutritional Diseases** are those caused primarily by diet. Non-specific enteritis (diarrhea) can be caused by poor quality feed ingredients. Deficiencies in vitamins and minerals can produce disease but are rare in commercial poultry because of the precise formulations used in preparing diets. However, deficiencies can be seen in backyard flocks when birds are given "scratch grain" diets alone. Another "nutritional" problem is obesity. The development of too much body fat can influence a lot of things especially liver function and reproduction.

11. **Others**: Pendulous crop, crop impaction, starveouts (chicks and poults that never learn to eat or drink), gizzard impaction are things that randomly occur in a flock especially in young birds. Pendulous crop can be treated by expelling contents and placing a loose figure 8 bandage (Vet-wrap) across the emptied crop (loop behind wings). Crop impaction can be treated by lavaging the crop with warm water to break up contents. If unresponsive to conservative management, the contents can be removed surgically (procedure = ingluviotomy – procedurally similar to a cystotomy in a dog).

C. **Integumentary**

1. **Fowl Pox** is caused by Poxvirus. Infected birds usually present with scabby lesions on unfeathered skin i.e., combs and wattles (Dry Pox). The virus can spread from bird to bird directly or by mosquitoes that feed on infected birds. The infection is generally self-limiting unless it involves the eyes, oral cavity or esophagus (Wet Pox), in which case it can result in starvation or aspiration of food into the lungs. There is a vaccine available for both chickens and turkeys.

2. **Necrotic Dermatitis** is a skin condition of chickens that occurs secondary to immunosuppression. Agents like IBD (see below) will ultimately impair the ability of birds to heal skin scratches and allow wounds to become infected with *Staphylococcus*, *Clostridium*, and *E. coli* that are found in the environment. Preventing immunosuppression is the key to preventing necrotic dermatitis. Treatment with antibiotics may help to resolve the skin infections (note: Bacitracin works against *Clostridium* but is not absorbed from the gut).

3. **External parasites** like mites and lice can be a problem in commercial flocks. Clinical signs include redness and irritation on the skin. Birds are generally restless and because of this, egg production may be off. In meat birds, skin condition may affect product grading. Treatment can be accomplished with insecticide dusts (Permethrin) in small flocks and by placing “No Pest Strips” (Rabon) in coops. Large flocks require insecticide spraying followed by cleaning and disinfection of the premise when the house is depopulated. Backyard poultry growers may want to go with a “natural” approach – 2’x2’x2” dust box filled with hardwood ash (from wood stove).

D. **Hematological**

1. **Marek's Disease** is caused by a herpes virus that induces the formation of lymphoid (B-cell) tumors in chickens. These tumors can spread, especially to the nervous system, where they cause such clinical signs as paralysis and blindness. Until a vaccine was developed, this disease greatly limited the growth of the Poultry Industry. Birds are vaccinated for Marek's disease at 1
day-of-age and are protected for life. Backyard producers should have this done by the hatchery if at all possible, since product comes in 1000 dose vials. One of the “must have” vaccines.

2. **Avian Leukosis** is caused by a retrovirus. Like Marek’s disease, it induces the formation of lymphoid (T-cell) tumors in chickens. These tumors can spread to a variety of tissues but generally do not involve the nervous system like Marek’s disease. The liver is one of the most common sites. This virus can spread from bird to bird or from hen to egg to chick. There is no vaccine for Avian Leukosis and it is untreatable. Getting rid of infected breeders is the best way to control this disease.

### E. Reproductive

1. **Retroviral Neoplasia** of the reproductive tract is one of the more common neoplasms. Typically will see ovarian or oviductal adenocarcinomas (with extensive abdominal metastasis) in older birds, especially those kept for 3+ years. Clinical presentation is typically that of enlarged, “doughy”, fluid filled abdomen, cachexia (especially breast muscle). Weight loss often goes unnoticed since birds continue to be active; eating and drinking until they “crash and burn”. Feathering tends to obscure the weight loss so unless owners are regularly picking birds up, they won’t notice the loss of muscle mass. No treatment.

2. **Viral and Bacterial Infections** of the reproductive tract can occur (retrograde movement from cloaca). Clinical signs associated with these infections include a drop in egg production, deformed eggs, decreased fertility and hatchability, and caseous masses in the oviduct. Bacterial infections can be treated with antibiotics but whether the bird will lay again depends on how much damage has been done to the reproductive tract. Viral infections like IB can be prevented by vaccination.

3. **Soft Shelled and Shell-less Eggs** are an indication of physiological problems. This can occur when calcium and phosphorus levels are out of balance in the diet or when mineral reserves have been depleted from bone towards the end of the egg production cycle.

4. **Vaginal Prolapse and Egg Yolk Peritonitis** occur with higher frequency in obese birds. That’s why it is important to keep birds from overeating especially when egg production is the objective. Increased deposition of fat in the abdominal fat pad results in an increase in intra-abdominal pressure and subsequent prolapse of the vagina and rupture of mature yolks (with only slight blunt concussive force to the abdomen e.g., hitting the ground hard). Egg yolk peritonitis is usually sterile, free yolk is however an irritant. Prevention involves monitoring feed intake to avoid fat pad build-up.

5. **Egg Binding (dystocia)** commonly occurs due to excessive abdominal fat or obstruction of the pelvic canal. Individual birds can be treated conservatively by increasing the environmental temperature, digitally lubricating the egg / cloaca, administering calcium gluconate (IV), and oxytocin. If medical management does not work, the egg shell can be collapsed by introducing a needle and aspirating the contents. Prevention - monitor feed intake.

### F. Musculoskeletal

1. **Viral Arthritis** is a disease primarily of chickens caused by a reovirus. The virus infects cells of the joint and tendon sheaths. The inflammation associated with infection weakens tendons (typically near the hock) causing them to rupture resulting in lameness. There is a vaccine against viral arthritis in chickens.

2. **Malabsorption Syndrome** (Field Rickets) is a secondary result of viral enteritis. Inflammation of the GI epithelium slows or prevents absorption of nutrients especially Vit D, Ca, P. This negatively effects bone mineralization, especially in fast growing young birds. The result is soft
rubbery bones and lameness. Treatment – Aqua-D in the water (3x recommended dose) to promote uptake. Also its helps to “stir” the birds regularly to get them moving and eating/drinking.

3. **Bacterial / Mycoplasmal Arthritis** is inflammation of the joint spaces caused by these organisms. Sometimes the organism can be introduced through a wound in the footpad. Agents like *Mycoplasma synoviae* can enter the bird via the respiratory system. The clinical presentation is lameness and swollen joints. This can be treated with antibiotics but is difficult to resolve completely. Birds infected with *Mycoplasma* tend to become carriers.

4. **Bumblefoot** is the name for swollen footpads. This can result from poor flooring conditions (wet litter, mud, very rough concrete) followed by bacterial infection of cracks in the footpad epithelium with *Staph., E. coli, Candida*. Very difficult to treat. Requires IM antibiotics, debriding, regular bandage changes (must heal by second intention).

5. **Articular (and visceral) Gout** is caused by the deposition of uric acid crystals in the joint spaces. The kidneys normally excrete uric acid (UA), but when they are not functioning properly, the concentration of UA builds up in the bloodstream and eventually spills out into the tissues (visceral) and joints (articular). Because the crystals take the form of sharp spikes, they can cause pain esp. in joints and on serosal surface where are heavily innervated with pain receptors. Preventing damage to the kidneys by vaccinating for IB and providing adequate fresh water at all times are good ways to prevent / manage.

G. **Immunological**

1. **Infectious Bursal Disease (aka IBD)** is caused by a Birnavirus. The virus replicated in B-cells found in the Bursa of Fabricius and ultimately destroys the bird’s ability to generate a humoral immune response to other infectious agents. As a result, birds succumb to secondary bacterial diseases like colibacillosis. Antibiotics can be used to prevent such infections, but ultimately birds should be vaccinated in IBD endemic areas.

H. **Cardiovascular**

1. **Round Heart, Ascites, Aortic Rupture, and Sudden Death Syndrome** are all disease related to a disparity between growth and organ development. Commercial birds have been genetically selected for rapid growth. Sometimes this growth outpaces the capacity of internal organs to compensate. Compensatory changes can therefore become pathological. This is particularly true for commercial broiler and turkeys; less so for backyard varieties.

I. **Neurological**

1. **Avian Encephalomyelitis** is caused by a picornavirus. Affected chicks and poults show signs of central nervous system inflammation i.e., incoordination, tremors, and seizures. There is no treatment for this disease. Prevention is accomplished through vaccination of breeding stock.

2. **Other Viral Encephalitidies** (Eastern Equine Encephalitis, Western EE, West Nile Virus, Highlands J virus) are caused by arboviruses. Birds are often considered reservoirs, but can on occasion develop clinical signs esp. with WNV. Signs can range from a precipitous drop in egg production to acute onset – seizures, coma, and death. The EEE/WEE vaccine has been used experimentally.

3. **Marek’s Disease** - As already mentioned, Marek’s disease virus produces tumors that have a propensity for invasion of the central / peripheral nervous system. The clinical signs reflect this – hind limb paralysis (sciatic nerve) and blindness (iridial / retinal nerve endings – pupillary edge will appear “fuzzy”).
4. **Bacterial Encephalitis** occurs when bacteria in the bloodstream spread to the brain. There they cause inflammation and damage which manifests as seizures, head tilting, blindness, etc. Treatment can be attempted using an antibiotic, but is often un rewarding because brain lesions may be difficult to resolve. Birds with impaired brain function may have difficulty eating, drinking, and walking.

5. **Dactylariosis** is a fungal disease caused by the mold *Dactylaria* and typically involves the brain. The fungus, which can be found in pine bark and “raw wood” shavings that have not been kiln-dried, colonizes the nasal passages and gradually eats its way into the calvarium. The clinical signs look much like any other viral or bacterial encephalitis.

6. **Vitamin E Deficiency** produces swelling and hemorrhage in the cerebellum of young chicks and turkeys (poults). Affected birds are uncoordinated and eventually die because as the cerebellum swells and herniates or compresses the brainstem. This disease is best prevented by feeding adequate levels of Vit E. Treatment with Vit E injections (IM) will help save those birds that have not begun to show clinical signs.

7. **Botulism** occurs when birds ingest material that contains pre-formed botulinum toxin. This toxin is produced by *Clostridium botulinum*, a bacterium that readily grows in decaying flesh and rotting vegetation where conditions are anaerobic. One of the more common ways that birds get botulism is by cannibalizing other birds that have been infested with maggots, which tend to concentrate the toxin. Affected birds develop paralysis that begins with their head/neck muscles and descends down the spinal cord, eventually involving their respiratory muscles. Severely affected birds will usually die. Others may survive as long as the source of the toxin is removed to prevent them from ingesting more. In affected birds, the neck feathers pull out very easily due to paralysis of the erector pili muscles. Oral lavaging/gavaging of the crop with a water suspension of activated charcoal can sometimes be helpful in treating individual birds. Removal of or limiting access to the source is imperative.

**Commonly Used / Currently Approved Drugs for Poultry (those most commonly used in backyard flocks are underlined) – not intended as a product endorsement:**

**Antibiotics:** Penicillin (Penn G Potassium), Bacitracin (BMD Soluble), Tetracyclines (Terramycin, Duramycin, Oxytet, Aureomycin), Lincomycin, Neomycin (Neo-terramycin), Gentamicin (Garasol, 1 day-old ckn, 1-3 day old tkys), Erythromycin (Gallimycin, soon to be pulled), Tylosin (Tylan), Virginiamycin, Sulfamethazine (Sulmet), Sulfadimethoxine (Sulfadimethoxine Sol. Powd.), Sulfaquinoxaline, Ceftiofur (Naxcel, for use in day-old birds only).

**Coccidiostats:** Amprolium (Amprol), Bambermycin, Decoquinate, Diclazuril, Halofuginone, Lasalocid, Monensin (Coban), Narasin, Nicarbazin, Salinomycin, Semduramycin, Sulfadimethoxine (Sulfadimethoxine Sol. Powd.), Sulfadimethoxine + Ormeptoprim

**Anti-endoparasitics:** Piperazine (Wazine), Fenbedazole (Safe-Guard, tkys, ckn), Hygromycin B (Hygromix, ckn)

**Anti-ectoparasitics:** Permethrin (Permethrin, Poultry Dust), Tetrachlorvinphos (Rabon – Impregnated Strips)

**NOTE:** Be sure to CHECK - Many products will say NOT FOR USE IN LAYING CHICKENS. This is because the number of bacterial/parasitic diseases seen commercial cage layers is limited and companies have tended not to pursue licensing for table egg birds. That said, extra label use in backyard birds is common. A
rational approach is look at the labeled withdrawal period for meat chickens (broilers) and add 10-14 days to account for a clutch cycle (time it takes for an ovum/yolk to mature prior to ovulation). It is important to advise the owner of the problems with regard to extra-label use – lack of data assuring that residues will be below allowable / detectable levels.

Info, chickens, approved drugs and vaccines: \[\text{http://www.drugs.com/vet/chickens-a.html}\]

Info, turkeys, approved drugs and vaccines: \[\text{http://www.drugs.com/vet/turkeys-a.html}\]

General resource for purchase of products packaged for birds: Foy’s Pigeon Supplies \[\text{http://www.foyspigeonsupplies.com}\] (provides good info on how to mix water meds by the gallon for clients that want to order direct) or Belle Farm \[\text{http://www.bellefarm.org/Products/products.html}\] or Jeffers Veterinary Supply – Poultry \[\text{http://www.jefferspet.com/pages/poultry}\]

General resource for husbandry supplies: \[\text{https://www.mcmurrayhatchery.com/index.html}\]

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