Regional Veterinary Laboratories (RVLs) carried out necropsy examinations on 1139 carcase submissions during May and June 2016. In addition, 5268 diagnostic samples were submitted and analysed during the same time period.

The following report presents a selection of the more interesting findings from carcase submissions to the laboratories situated in Athlone, Cork, Kilkenny, Limerick, Sligo and Dublin during May and June. Staff in RVLs provide assistance to private veterinary practitioners in diagnosis of many diseases and conditions that affect livestock on Irish farms through specialist expertise in pathology, bacteriology, virology, parasitology, epidemiology and disease investigation.

Cattle

Gastrointestinal System

Neonatal enteritis

<table>
<thead>
<tr>
<th>Enteric pathogen</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E.coli</em> K99</td>
<td>0.6%</td>
</tr>
<tr>
<td>Coronavirus</td>
<td>0.9%</td>
</tr>
<tr>
<td><em>Salmonella</em> spp.</td>
<td>0.7%</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>19.0%</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>28.8%</td>
</tr>
</tbody>
</table>

Table 1. Frequency of agents identified in calf diarrhoea samples submitted to RVLs during May and June 2016

Mycotic rumenitis

A one-week-old calf that had been receiving treatment for diarrhoea was submitted to Kilkenny RVL. At necropsy, there were multifocal 0.5-1cm raised circular roughened lesions on the wall of the rumen suggestive of a mycotic rumenitis. Histopathology confirmed a necro-suppurative hyperkeratotic mycotic rumenitis.

Mycotic rumenitis is associated with prolonged antibiotic administration or with pH changes in the rumen which disrupt the normal bacterial microflora and allow fungal colonisation and invasion of the mucosa (mycosis).

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Figure 1. Mycotic plaques on the mucosal surface of the rumen in a calf that had been treated for diarrhoea. Photo: Maresa Sheehan

Adenovirus enteritis

A four-month-old calf on pasture died after a period of ill-thrift and was submitted to Cork RVL. Other calves in the cohort were in poor body condition and some had a persistent scour despite antibiotic and coccidiostat treatment. Gross examination revealed marked congestion of the intestinal epithelium and intestinal mucosal necrosis. The small intestine contained blood-tinged contents. Routine cultures of organs and intestinal content were unrewarding with only a light coccidial infection detected in intestinal contents.

Histopathological lesions observed in sections of intestine and abomasum consisted of mucosal necrosis, inflammatory infiltration and vascular thrombosis with large basophilic intranuclear inclusion bodies present in some endothelial cells of the lamina propria and submucosa of the intestine.
and abomasum (see Figure 2) The inclusion bodies were considered consistent with bovine adenovirus 2 infection which was later confirmed by PCR assay of the intestinal contents.

Bovine adenovirus infection is usually clinically inapparent but in immunosuppressed animals it can cause severe pneumonia and ulcerative enteritis. Clinical disease is influenced by various factors including the strain of virus, concurrent infections, stress, environmental conditions and management practices. Ill-thrift and diarrhoea in this case and in cohort animals was thought to be due to bovine adenovirus 2 infection. This virus is transmitted by the faecal-oral route. In infected herds young calves tend to be protected by colostral antibody, the peak incidence of clinical cases is between three and five months of age as colostrum-derived immunity wanes.

Respiratory System

Lungworm

Deaths in four- to six-month-old calves at pasture were attributed to acute Dictyocaulus infection (hoose) based on epidemiology and gross lesions in all RVLs during May and June 2016. The characteristic clinical signs described were an acute onset of distressed breathing in several animals in the group, particularly after exercise. Emphysema and atelectasis of varying severity were often the only gross lesions observed (see Figure 3) in these cases. Larvae in the lumen of the bronchioles are not likely to be observed in young animals with an acute pre-patent infection. Negative faecal larval results can also be misleading when attempting to diagnose a clinical outbreak of acute lungworm infection. Deaths may occur rapidly but less severely affected animals are likely to respond to anthelmintic therapy.

Pleuritis

Pleuritis may arise from a variety of causes as demonstrated by recent cases in Kilkenny RVL and Sligo RVL.

Fibrinous pericarditis and pleuritis of the right lung was diagnosed in a seven-year-old cow submitted to Sligo RVL. The farmer reported the cow had been walking slowly with an arched back. The right lung was adhered to the rib cage by fibrous tags. *Trueperella pyogenes*
was cultured from the lesions. The most likely underlying cause of the pleuritis and pericarditis in this case was “hardware disease” following ingestion of a sharp foreign object into the reticulum which penetrated the diaphragm.

Pleuritis subsequent to respiratory infection was diagnosed in a three-month-old calf with a history of sudden death submitted to Kilkenny RVL. *Pasteurella multocida* was isolated from the lungs and histopathological investigation revealed a severe fibrinosuppurative bronchopneumonia with pleuritis.

Bacterial culture of the lesions in the larynx and lungs yielded a growth of *Pseudomonas aeruginosa*. This species is an opportunistic bacterial pathogen. A positive result for bovine herpesvirus 4 (BHV-4) was found on PCR testing of the lungs.

A morphological diagnosis of chronic necrotising laryngitis with multifocal secondary pneumonia was made. The pneumonia was very likely to have been a sequel to the laryngitis where infected material was aspirated into the lungs. Necrotic laryngitis is associated with bacterial infections such as *Fusobacterium necrophorum*, though predisposing lesions may include trauma or viral infection such as IBR or bovine papular stomatitis. Bovine herpesvirus 1, the causative agent of IBR was not detected on testing. BHV4 was detected in the lung. BHV4 has previously been implicated in pneumonia and tracheitis.

**Laryngitis**

A 15-month-old heifer was submitted to Kilkenny RVL with a history of chronic ill-thrift and suspected pneumonia. At necropsy, the laryngeal mucosa was covered by a pale yellow diphtheritic membrane, and there was bilateral multifocal necrosis of the laryngeal mucosa, with focally extensive necrosis of the cranial edge of the epiglottis. There were several foci of consolidation scattered throughout the lungs.

This report is based on findings from Department of Agriculture Food and Marine Regional Veterinary Laboratories based in Athlone, Cork, Dublin, Kilkenny, Limerick and Sligo. Further information including submission forms and prices can be found at [www.agriculture.gov.ie/animalhealthwelfare/laboratoryservices/regionalveterinarylaboratories](http://www.agriculture.gov.ie/animalhealthwelfare/laboratoryservices/regionalveterinarylaboratories)
Louping ill and concurrent *Mannhaemia haemolytica* pneumonia were diagnosed in a two-month-old calf submitted to Sligo RVL in May. There was severe focally extensive chronic cranioventral bronchopneumonia with multifocal abscessation. There were several ticks observed in the axillary and inguinal areas of the calf, which raised suspicions of a tick-borne disease later confirmed by histopathology and virology. Co-infection with a tick-borne disease such as tick borne fever, can often worsen the effect of other pathogens with young animals particularly susceptible to pneumonia.

**Cardiovascular System**

**Valvular endocarditis**

A 29-month old, first lactation cow was submitted to Kilkenny RVL with a history of acute pneumonia and death despite antibiotic treatment.

Examination of the heart at necropsy revealed that the right atrioventricular valve multifocal thickened nodules with adherent thrombi on the free margins. The liver was diffusely enlarged with rounded edges and a “nutmeg liver” lobulated appearance on the cut surface. The lesions are consistent with right atrioventricular valvular endocarditis and chronic passive hepatic congestion.

A large (1 cm diameter) atrial septal defect was found in a neonatal calf submitted to Sligo RVL. The calf, which weighed 72 kg, had
been born by caesarean section, had been in respiratory distress since birth. At necropsy, the lungs were congested and oedematous, due to the cardiac defect preventing the neonatal calf from making the necessary physiological circulatory transition from the in-utero environment.

**Terminal dry gangrene.**

A five-week-old calf presented to Kilkenny RVL with a history of recumbency and skin lesions on the ear tips and the hindlimb extremities. Antemortem, the animal was bright and alert, but had been recumbent for some time. Bilaterally the distal hindlimbs were dry, cold, excoriated and had a distinct linear ulcerated border between normal tissue above the fetlock and the affected terminal area. Bilaterally the ear tips were sloughed with irregular roughened edges. The liver was golden brown. The spleen was adhered to diaphragmatic lobe of the liver and within the adhered portion there was a focal hard yellow dry 3cm diameter abscess. There was focally extensive coagulative necrosis of the ear tip which was bordered by a dense rim of inflammatory cells, comprised predominantly of neutrophils. There was focally extensive ulceration of the skin. The sub-epithelial vessels contained fibrin thrombi and were surrounded by a dense rim of inflammatory cells, consistent with thrombosing vasculitis.

The limb and ear lesions are consistent with terminal dry gangrene. *Salmonella Dublin*, which has a well-established association with this condition was isolated from the spleen.

![Figure 8: Terminal dry gangrene of the hind limb of a calf. Photo Margaret Wilson](image)

**Tick-borne Fever**

During the latter part of May, several blood samples were sent to the Cork RVL for identification of *Anaplasma phagocytophilum* (tick-borne fever). The usual clinical history described by the submitting practitioners was pyrexia, anorexia and milk drop, mainly affecting purchased animals rather than in home-bred animals. Coughing was also reported in one case. Intracytoplasmic inclusions are only seen in the febrile period of the disease, and other non-specific haematological changes may include leukopenia and thrombocytopenia.
Prior to death, the calf became lethargic and hyperpnoeic. Gross examination revealed pulmonary consolidation and white-spotted kidneys. A severe suppurative meningitis was detected by histopathology which was likely to have had a bacterial aetioloogy. It was not clear if the meningitis was related to the earlier episode of diarrhoea, but meningitis is a relatively common sequel to bacteraemia following gastrointestinal, respiratory or umbilical infections in young calves.

In a similar case but more explicitly related to a primary umbilical infection, a one-week-old calf was submitted to Kilkenny RVL with a history of recumbency. At necropsy, the anterior chamber of the right eye contained white opaque material. An umbilical abscess was present. There was 30% cranioventral lung consolidation. There were miliary white pinpoint foci on the renal cortex. The meninges were cloudy to opaque with adhesion of the meninges to the ventral cranial vault. Cerebellar coning was present, indicating increased intracranial pressure. Purulent material was present in the left hock joint, indicating septic arthritis.

On histopathological examination of the eye the anterior chamber contained a large floating raft of fibrin with emmeshed neutrophils and occasional bacterial colonies, consistent with hypopyon. The drainage angle was blocked by neutrophils. Within the lungs multiple alveoli contained debris, neutrophils and macrophages, consistent with bronchopneumonia. Within the kidney there were multifocal interstitial areas of fibrin exudation with myriad viable and degenerate neutrophils. Diffusely throughout the brain the meninges were expanded by fibrinous exudate, large numbers of neutrophils and macrophages, consistent with fibrinosuppurative meningitis.

\textit{Escherichia coli} was isolated from the meningeal swab indicating \textit{E. coli} bacteraemia as the most likely cause. The ZST indicated adequate colostral immunity, but this will not
Hypopyon is a rarely recorded lesion of neonatal bacteraemia/septicaemia in calves. It is considered that any organism capable of causing bacteraemia/septicaemia systemically can also cause endophthalmitis which is typically suppurative in nature. It is postulated that most cases go undetected as the lesions are microscopic in nature and the disease is often rapidly fatal. This case demonstrates haematogenous infection of the eye resulting in grossly visible hypopyon.

Biopsy material was submitted to Kilkenny RVL from a bullock that had a history of ulcerative raised circular lesions on its legs and tail. Histopathological examination of the biopsy revealed an unencapsulated expansile infiltrative mass in the deep dermis and subcutis. The monomorphic neoplastic cells had granular cytoplasm and were arranged in sheets interspersed by sparse stroma. Toluidine blue staining confirmed these neoplastic cells were mast cells.

Mast cell tumours are rare in cattle. Scant data available suggests that cutaneous mast cell tumours are usually multiple and associated with visceral mast cell aggregates although purely cutaneous tumours have been reported.

Skin

**Mast cell tumor**

Intoxication

Lead poisoning.

Lead poisoning was diagnosed by Athlone RVL in an 18-day-old calf which displayed nervous clinical signs. Necropsy, findings were non-specific although multifocal thymic haemorrhages, pulmonary atelectasis and pale hind limb musculature were noted. The lead concentration in a sample of the kidney was very high confirming toxicity. One other calf from the group had died before this carcase was submitted to the laboratory. The private veterinary practitioner and the local Regional Veterinary Office were notified to ensure that
there could be no subsequent risk to the food chain.

**Chronic pyrrolizidine alkaloid hepatopathy**

Pyrrolizidine alkaloid hepatopathy as a result of contamination of silage with ragwort (*Senecio jacobea*) was diagnosed in two different farms by Cork RVL. In one of the farms, five animals presented with neurological signs that prompted the veterinary practitioner to consider hepatic encephalopathy. An on-farm post mortem examination was carried out by the practitioner and tissue samples were submitted for histopathology to Cork RVL. The submitted liver sections revealed extensive disruption of the hepatic cords, fibrosis, marked bile duct proliferation and megalocytosis (see Figure 12).

**Megalocytosis is a characteristic histological feature of pyrrolizine alkaloid toxicity.** In order to replace cells lost to necrosis, hepatocytes attempt to divide; however, pyrrolic esters inhibit cellular mitosis without inhibiting DNA synthesis, resulting in characteristic megalocytosis in which hepatic cells have abundant cytoplasm and nuclei up to twice the normal size. Farmers are advised to take steps to reduce silage contamination by ragwort.

![Figure 12 Photomicrograph showing cells with abundant cytoplasm, enlarged nuclei with fragmented chromatin and prominent nucleolus (megalocytosis, green arrows). Note a normal hepatocyte (blue arrow) for comparison (Photo Cosme Sánchez-Miguel).]

**Sheep**

**Pneumonia and coccidiosis in lambs.**

Pneumonia and coccidiosis were very frequent diagnoses in lambs submitted to Sligo RVL and other RVLs during May and June. In one of these submissions to Sligo RVL, lambs had been housed with their dams and were being creep fed. Lesions observed at necropsy included severe cranoventral pulmonary consolidation, pulmonary oedema and necrotizing enteritis. *Bibersteinia trehalosi* was cultured from the lungs and spleen of several of the lambs indicating a likely septicaemia and high numbers of coccidial oocysts were detected in the faeces. In another submission to the same laboratory, where ten lambs had died in a short space of time on a farm and large numbers of coccidial oocysts were present in faeces. *Mannhaemia haemolytica* was cultured from the lung. Bilateral nephrosis was observed in one of the lambs. Nephrosis can occur after an outbreak of coccidiosis. The underlying aetiology is underdetermined but is probably related to a toxic insult. Sligo RVL also reported abomasal trichobezoars (wool-balls) in these lambs which was a common finding this spring. It is surmised that poor grass growth in late spring in certain areas of the country may have impacted on maternal milk supply and the resulting hunger and pica may have predisposed to this condition in lambs.
**Ovine pulmonary adenocarcinoma**

Ovine pulmonary adenocarcinoma (OPA, formerly jaagsiekte) was diagnosed by Athlone RVL in a 15-month-old hogget from a flock with endemic OPA. At necropsy, there was marked bilateral cranioventral pulmonary consolidation with multifocal white firm lesions, 3-4 cm in diameter, in the right caudal lobe and in the left cranial lobe. Histopathology confirmed ovine pulmonary adenocarcinoma with concurrent bronchopneumonia. *Mannheimia haemolytica* was isolated by culture and detected by PCR. OPA is caused by jaagsiekte sheep retrovirus and has become endemic in some Irish flocks. It is spread by direct contact and nasal secretions from infected carrier sheep. Management practices such as housing and confinement facilitate spread. Fifteen months is considered young for a sheep to develop clinical OPA as it typically has a long incubation period and usually presents in sheep older than 2 years. It is likely in this case that the bronchopneumonia was the ultimate cause of death.

**Peritonitis and pyelonephritis**

A lamb was submitted to Kilkenny RVL with a history of having been found dead. The umbilicus was enlarged and contained an abscess. There was diffuse severe fibrinous peritonitis. The left kidney was markedly enlarged and covered with a cream-white irregularly pitted fibrinous suppurative membrane, and there were miliary 1-2mm white spots on the renal cortical surface which often coalesced into larger areas. The renal medullae was enlarged and filled with pus. On histopathological examination within the kidney, the normal renal architecture had been replaced by multifocal to coalescing intra-renal abscesses *Staphylococcus aureus* was isolated from both kidneys. This is a pyogenic organism that is a normal commensal of the skin. The most likely route of infection of the kidney and peritoneum in this case was umbilical.

![Figure 13: Multifocal to coalescing renal abscesses due to *Staphylococcus aureus*. Photo Margaret Wilson](image)

**Mastitis**

An aged ewe was presented to Kilkenny RVL having been found dead. At necropsy, her lungs were diffusely congested and emphysematous. Her left mammary gland was enlarged, hard and dark red and contained watery yellow milk with abundant fibrin clots. On histopathological examination there was a necrosuppurative bronchopneumonia and a necrosuppurative mastitis. *Mannheimia haemolytica* was isolated from the mammary gland, milk and lung. *M. haemolytica* is a common cause of pneumonia and severe mastitis in sheep.

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Copper toxicity

A four-year-old Texel ewe was submitted to Kilkenny RVL. At necropsy, the carcase was in good body condition with ample adipose reserves. The sclera and subcutaneous fat were diffusely moderately icteric. The kidneys were bilaterally, moderately enlarged to 9 & 9.5 cm in length and diffusely dark purple-black in colour. The urine was golden-brown. Histopathological examination of the kidney revealed marked tubular necrosis and haemoglobinuria. In ancillary testing the animal’s liver copper concentrations were above the normal range, suggesting copper toxicity as the most likely cause of the intravascular haemolysis responsible for the icterus, haemoglobinuria and subsequent nephrosis.

Death in cases of chronic copper poisoning occurs due to the haemolysis precipitated by the acute release from the liver of stored copper into the circulation. Hepatic release of toxic levels of stored copper can follow stress, hepatocellular copper overload (due to increased copper ingestion or decreased molybdenum) or hepatocellular damage. The Texel breed is known to be particularly sensitive to copper toxicity.

Horses

Tyzzer’s disease

A three-week-old foal was found comatose and died quickly without receiving treatment and was submitted to Cork RVL. Mild icterus was observed, the liver was enlarged and congested and displayed white pinpoint foci throughout the parenchyma (see Figure 15). Initially, *Rhodococcus equi* septicaemia or equine herpesvirus 1 were suspected based on its history and gross lesions but subsequent tests were negative. Histopathological examination revealed multifocal areas of hepatic necrosis. At the periphery of the hepatic necrotic foci, filamentous bacilli were observed within surviving hepatocytes. Silver-stained tissue sections confirmed presence of intracellular clusters of long slender bacilli consistent with *Clostridium piliforme* (clostridial hepatitis, Tyzzer’s disease).

*Clostridium piliforme* is transmitted by the faecal-oral route and spreads to the liver via the portal circulation. Rodents may play a role in the epidemiology as reservoirs. The infection mainly occurs in debilitated or immunocompromised animals.

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Figure 16. Microphotograph demonstrating intracellular silver-staining bacilli (arrow) consistent with *Clostridium piliforme* in a foal that died of Tyzzer’s disease. (Photo Cosme Sánchez-Miguel).