MICROSCOPICAL DIAGNOSIS.

Liver: Shows extensive changes, the contour of the columns much interfered with. The regular formation of lobules is no longer distinct in places, and there seems to be a reduction in the size of these lobules. There seems to be loss of liver cells present, and only their nuclei are apparent; extensive changes in the cytoplasm, which stains badly, or not at all, and with Sudan III shows the presence of fatty substances, even those cells which are least affected. With the Sudan III stain, the lobule shows a most irregular distribution of fatty substances, of all sizes and shapes; some irregular. Interspersed in this are light greyish areas with and without nuclei. The nuclei are of different sizes and a network of distended canaliculi is seen. With haemalum-eosin dispersed through the lobule but especially around the central vein, are numerous cells with a yellowish-brown granular cytoplasm; these cells are filled to bursting with this pigment. With difficulty a nucleus is made out in some, and it appears to be different from the nucleus of a liver cell. They are poor in chromatin, not round, but somewhat angular in shape. With Sudan III the majority of these cells stain a brownish colour. With Berliner Blue granules stain light yellow-brown. No Haemosiderin in these cells seen. In some of the liver cells canaliculi are filled with bile pigment, and stand out as linear markings across the liver cells. In the periphery there is an increase of connective tissue elements in which there are numerous nuclei of bileducts, fibrocytes and round cells. It gives one the impression of bile duct proliferation here and there and regeneration of liver cells. With Van Gieson here and there around the central vein there is an increase of connective tissue fibres and the blood vessels are found distended. With Giemsa it will be found that these pigment cells stain differently to the liver cells.

Smear from Liver: Liver cells with bile pigment in canaliculi, which stains a greenish-brown. Free nuclei probably of liver cells, desquamated and pigmented reticulum cells. No erythrophagocytosis seen in stern cells.

Kidney: With Sudan III some tubuli contorti show hydropic degeneration; large vacuoles seen in the cytoplasm and along the periphery the droplets are small. Some tubules exclusively show minute fat droplets, these also present in the epithelium of the medulla. Some tubules show hyaline droplet degeneration. A number of the tubules, also in the medulla, contain a light yellowish-brown pigment, in the form of discs; some about the size of erythrocytes, in some tubules granular and smaller lumps present. With haemalum-eosin there is a good deal of yellow-brown pigment in the lumen of tubules. Necrobiosis of some tubuli (karyolysis). With Berliner Blue here and there very slight diffuse blue staining of a few tubules, but the Haemoglobin stands out chiefly as yellowish-green pigment masses.

Smears from Kidney: Large amount of dark yellowish-green pigment in in the form of granules.

Lungs: Here and there some haemosiderin. With Sudan III numerous cells associated with the alveolar walls, the greater majority of which are filled with fat droplets staining deep orange-red. The droplets vary in size, from minute ones to those much larger; some of these cells contain a fine, granular brown pigment.

Lung Smears: Free nuclei, endothelials, numerous neutrophiles and lymphocytes. No sign of erythrophagocytosis.

Myocard: Shows fairly extensive minute fat droplet formation in the fibres affecting practically all muscle fibres. With Berliner Blue no haemosiderin seen.

Spleen: With haemalum-eosin shows well-defined follicles, the rest is filled with blood and numerous cells (endothelials) are seen containing a brownish pigment. This pigment is probably all haemosiderin as shown by the Berliner Blue stain; much more of this pigment present than described in the case of the normal animal. With Sudan III the majority of these pigment cells show the presence of fat droplets (minute), some cells show it more than others.

Spleen Smears: Free nuclei of cells; monocytes, neutrophiles, lymphocytes.

Periportal Lymph Gland: Majority of sinus cells show minute droplets of fat with Sudan III. In follicles large brown cells seen, and in one place in the medulla they resemble as regards size, shape, nuclear nature, and character of granules, the type of cell seen in the liver (no haemosiderin): these cells are incorporated in the stroma of the medulla.

Organ Smears: Lymphocytes, eosinophiles,, neutrophiles; few reticulum cells with pigment granules of a dark bluish-green colour (c.f. liver).

Prescapular Lymph Gland: Same as above, as regards sinus cells, except that besides fat the sinus cells also contain brown pigment. With Berliner Blue no haemosiderin, but the golden-yellow pigment in these cells, although

slightly more scanty, and slightly coarser in character, appears to be somewhat similar to that seen in the liver.

Organ Smears: Same as periportal; note reticulum cells with pigment granules, like those seen in the liver.

Iliac Lymph Gland: The sinus cells have a bluish tinge in places, not granular, but diffuse; accordingly in places it stands out as a very light bluish network. In places the sinus cells show golden granular pigment.

Haemolymph Gland: With Sudan III extensive minute fat droplets in endothelial cells, and this stands out as a network. With Berliner Blue not haemosiderin, but golden-yellow pigment granules seen in these cells.

Mesenteric Lymph Gland: As regards the presence of fat droplets and pigment (golden-brown granular) similar to above, e.g., Iliac lymph gland. With Berliner Blue no iron, but golden-yellow granular pigment. With haemalum-eosin some cells show erythrophagocytes (red cells in cell), but majority show presence of brown granular pigment.

Liver Smears: Liver cells with pigment in canaliculi; monocytes; no erythrophagocytosis seen.

Lung Smears: *Endothelials*: probably alveolar. *Endothelials*: vascular (?) *Neutrophiles*: frequent. *Lymphocytes*: not infrequent. No sign of erythrophagocytosis.

Bone Marrow Smears: Rich regeneration of blood. Numerous cells of eosinophile group, especially those types just before the ripe stage. No erythrophagocytosis.

Periportal Lymph Gland Smears: Lymphocytes,, eosinophiles, few neutrophiles: few reticulum cells with pigment granules, dark greyish blue.

Mediastinal Lymph Gland Smears: Ditto.

SHEEP No. 15160.

Particulars of P.M.	*Macroscopical Diagnosis.*
P.M. on 27.9.26. P.M. No. 5914. Spec. No. 6291. Merino Hamel. Aged.	*Pathological Anatomical Diagnosis.*—Anaemia; haemoglobinaemia; haemoglobinuria; general icterus; swelling, pigmentation, and degeneration of kidneys; degeneration and pigmentation of liver; pigmentation and tumour splenis. Caseous lymphadenitis bronchial and mediastinal lymph glands; swelling and pigmentation other lymph glands; parasitic nodules in intestines; slight constipation. *Etiology.*—Killed in extremis, (Enzootic Icterus.)

MICROSCOPICAL DIAGNOSIS.

Liver: Disappearance of liver cells around central veins, fatty degeneration of majority of remaining liver cells, hyperaemia, reticulum cells with pigment, and bile stasis. With Berliner Blue no haemosiderin, but desquamated reticulum cells with pigment stand out prominently. With Sudan III, fat droplets in liver cells stain brick-red, whereas pigment granules in reticulum cells stain yellow-brown. Bile pigment in canaliculi stain yellowish-green. Note therefore, three types of pigment with Sudan III:—(1) fatty substances in liver cells; (2) yellow-brown pigment in reticulum cells; and (3) bile pigment (greenish-yellow) in bile ducts. There is also evidence of slight interstitial hepatitis.

Kidneys: The majority of tubuli filled to bursting with haemoglobin, and stains a brick-red colour with haemalum-eosin; here and there evidence of haemosiderosis and this stains reddish brown. The haemoglobin is homogeneous-looking and extends from the cortex into the medulla. Many of the Bowman's capsule spaces are also distended with this pigment. The blood vessels in the medulla show extensive hyperaemia. The epithelium of the tubuli show the nuclei fairly well maintained; here and there nuclei are missing, but the cytoplasm has a granular appearance, hyaline droplet degeneration, and mixed with it are some pigment granules. With Sudan III no fatty changes seen.

Myocard: Fairly extensive fatty infiltration. Numerous droplets of fat, scattered fairly evenly over the muscle fibres.

Lungs: Slight hyperaemia, desquamated cells with yellowish-brown pigment in the capillaries, not frequent. Here and there (very few) a cell with evidence of haemosiderin. The desquamated cells become more evident with the Sudan III stain; they appear to be of the nature of reticulum cells filled with a brown granular pigment. (These are of same nature as those seen in the liver.)

Lung Smears: Cells with blue pigment granules like those seen in liver smears. (See Plate VI.)

Spleen: Lymphoid tissue is not too prominent; in pulpa a fair amount of haemosiderosis, but not extensive. The sinuses are free of pigment, and contain a good deal of blood.

Lymph Gland No. 1: With haemalum-eosin desquamated cells with brown pigment. With Sudan III these cells appear more prominent and are filled with a yellowish-brown granular pigment of unequal sizes. Masses of cells in the lymphoid tissue contain reddish-brown pigment. A number of the desquamated cells in the sinuses with Berliner Blue stain show the presence of haemosiderin besides some other brown pigment granules, i.e. note therefore two types of pigment in the desquamated cells, whereas the pigment in the reticulum cells associated with the lymphoid tissue is of a different nature.

Lymph Gland No. 2: Very extensive desquamation and pigmentation of endothelials, which show up very prominently with Berliner Blue. Some granules stain blue, whereas others remain brown. With Sudan III the pigment stains greenish-yellow, and in between the pigment one can actually discern droplets of fat. However, not many of these droplets present. Some cells thus contain three types of pigment: (*a*) Haemosiderin (reddish-brown), (*b*) greenish-brown pigment (bile pigment), and (*c*) fat droplets (brick-red) (see plates showing lung endothelials, No. 5949).

Bone Marrow: Besides prolific regenerating cells of the eosinophile type, nothing unusual seen.

Liver Smears: (1) *Reticulum cells*: with greyish-blue globular pigment.

(2) *Liver cells*, some with yellow-brown pigment, and others with casts of canaliculi filled with dark greenish-brown pigment.

Spleen Smears: Good deal of blood, monocytes, nuclei of endothelials. In the section extensive erythrophagocytosis seen, yet in the smear none of these cells encountered.

Periportal Lymph Gland Smear:

1. Lymphocytes, lymphoblasts.
2. Endothelials of the type of stern cells.
3. Reticulum cells with globular, greyish-blue pigment granules like those encountered in the liver.

Bone Marrow Smears: Large number of cells of the eosinophile group.

SHEEP No. 14342.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 11.2.26. P.M. No. 5284. Spec. No. 5751. Merino Hamel. Condition good. Full mouth.	*Liver.*—Swollen; lobulation fairly distinct; yellow-brown in colour; central vein prominent, surrounded by a yellowish zone. *Kidneys.*—Adipose tissue of fat capsule a canary-yellow colour; kidneys swollen; cut surface dark dirty chocolate colour; edges everted; striations in the cortical zone; consistence soft. *Spleen.*—Swollen; edges rounded; on section cut surface has a dark chocolate colour; edges everted; consistence soft and easily scraped off. *Bladder.*—Coffee-coloured urine. *Pathological Anatomical Diagnosis.*—General icterus; haemoglobinuria; hyperaemia lymph glands; oedema of lungs; extravasations left endocardium; hyperaemia, degeneration and extensive pigmentation liver; swelling and marked pigmentation kidneys; tumour splenis; haemonchosis; oesophagostomiasis. *Etiolgy.*—Enzootic Icterus.

MICROSCOPICAL CHANGES.

Liver: Shows atrophy of liver cells in the neighbourhood of the central vein. In some lobules large part of the acinus implicated, and show large pigment cells. This pigment is not haemosiderin. Here and there a few desquamated stern cells, with iron pigment. Some of the bile vessels distended with yellowish-green homogeneous material. In places the interlobular spaces are infiltrated with round cells and interspersed in it are a few pigment cells.

Kidneys: Necrosis of tubuli contorti. Some tubuli contain yellowish homogeneous material, i.e. haemoglobin. With Berliner Blue in some tubuli haemoglobin present, other tubuli have a diffuse light blue colour in which are embedded small haemosiderin granules.

Lungs: Show oedema. The alveolar walls stand out as a network, comprised of cellular elements, lying end to end. These cells are filled with haemosiderin. *What is their origin?* Seeing that very little desquamation

of stern cells took place in the liver, does the endothelial lining of the lung capillaries transform freed haemoglobin into haemosiderin, or was this done outside the lung?

SHEEP No. 14734.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 25.8.26. P.M. No. 5854. Spec. No. 6201. Merino Hamel. 6 Tooth. Condition fair.	*Pathological Anatomical Diagnosis.*—General icterus; haemoglobinuria; haemoglobinaemia; sub-epicardial extravasations; degeneration myocardium; oedema and hyperaemia of lungs; pigmentation and degeneration of liver; extensive pigmentation and degeneration kidneys. *Etiology.*—Enzootic Icterus.

MICROSCOPICAL CHANGES.

Liver: Disorganization of columns of liver cells and atrophy, affecting about half of lobule around the central vein. Majority of the desquamated reticulum cells show brownish-yellow pigment with haemalum-eosin, Sudan III, and with Berliner Blue stains. Much debris between liver cells. No iron seen. Good number of liver cells show fat droplets.

Kidney: Slight bluish colour of some tubules with Berliner Blue stain, but there is more haemoglobin present, which is of a yellowish-green colour.

Lung: Good deal of haemosiderin in lung, but lightly stained.

Spleen: Fairly well marked haemosiderosis associated with pulpa.

SHEEP No. 11418.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 27.1.25. P.M. No. 4327. Spec. No. 4678. Merino Hamel. Full mouth. Good condition.	*Pathological Anatomical Diagnosis.*—General icterus and anaemia; haemoglobinaemia; haemoglobinuria; pigmentation liver and kidneys; hyperaemia of lungs; tumour splenis; slight acute catarrhal enteritis. *Etiology.*—Enzootic Icterus.

SHEEP No. 11377.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 3.2.25. P.M. No. 4342. Spec. No. 4204. Merino Hamel. Full mouth. Condition good.	*Pathological Anatomical Diagnosis.*—Generalized icterus; hyperaemia of lymph glands; pigmentation and degeneration of liver; enlargement and pigmentation kidneys; slight acute cholecystitis; acute catarrhal enteritis; slight acute follicular laryngitis; constipation. *Etiology.*—Enzootic Icterus.

SHEEP No. 14708.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 30.8.26. P.M. No. 5844. Spec. No. 6208.	*Pathological Anatomical Diagnosis.*—Anaemia; slight pigmentation and fatty degeneration liver; pigmentation kidneys; hyperplasia of Malpighian bodies spleen; haematoma right jugular region. *Etiology.*—Sequel blue-tongue bleeding, and complicated with Enzootic Icterus.

MICROSCOPICAL CHANGES.

Liver: With haemalum-oesin stain, the columns of liver cells well preserved; the chief changes in this case are associated with the vessels in Glisson's capsule, which show round-cell infiltration and an increase of bile ducts. In between these cell foci are numerous pigment cells, which are filled with a brownish, regular minute granular pigment. These cells vary in size and shape from cells the size of monocytes to those which are much larger than two liver cells. In places these lie in the interstitium, completely removed from liver cells (See Plates V and VI). These cells are present here and there in the liver lobule and have a linear arrangement, and in places numbers of these cells occur in clusters. These cells show clearly in this section that they have nothing to do with liver cells; they are reticulum cells. These cells are seen

in various stages of formation, exemplified by the variations in the sizes of these cells. This is probably an early case, before much damage to liver parenchyma has taken place. Very little other pigment present.

Kidneys: Slight necrosis and extensive haemosiderosis; also haemoglobin present in lumen of tubules.

Spleen: Very extensive haemosiderosis associated with the endothelial cells of the pulpa. In the lymphoid tissue, which is well developed, there is no trace of haemosiderin. With haemalum-eosin haemosiderin stains yellow-brown, and present in the form of granules in the cells.

Lungs: Slight hyperaemia, and here and there some (not many endothelials) cells with haemosiderin granules.

APPENDIX III.

This deals with the macroscopical and microscopical changes observed in sheep affected with Bacterial Icterus.

SHEEP No. 10517.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 4.11.26. P.M. No. 5975. Spec. No. 6343. Merino Hamel. 4 Tooth. Condition fair.	*Pathological Anatomical Diagnosis.*—Generalized icterus; haemoglobinuria; tumour splenis; anaemia; haemorrhages under capsule of kidneys; parasitic nodules intestines. *Etiological Diagnosis.*—Bacterial Icterus experiment. Killed for collection of material.

MICROSCOPICAL CHANGES.

Liver with haemalum-eosin: one-third to half of the lobule around the central vein shows regressive changes, and is very well differentiated from the rest of the lobule. This is associated with extensive alterations in the staining propensities of the cytoplasm. Around the central veins there are liver cells which are no longer lying in columns, but dissociated, and stain light pink, whereas the intact liver cells, bordering on this zone, show up as a light reddish-purple. These cells in the centre show all stages of necrobiosis, i.e. pyknosis to karyolysis. With Sudan III the majority of the liver cells around the central vein, which have become dissociated, show the presence of brick-red droplets, from minute to medium sized ones. Some liver cells contain a yellow-brown pigment. This is particularly well seen with the iron stain. The fat as such, which forms the bulk, has disappeared, and only in some cells there remain a few minute yellow-brown granules. Stern cells filled with haemosiderin especially seen in that portion of the liver around the periphery. With Giemsa note that the appearance of pigment in these cells around the central vein is different to that observed in Enzootic Icterus. With Sudan III in Bacterial Icterus the pigment is in the form of brick-red droplets of different sizes, whereas in case of Enzootic Icterus, the pigment is yellowish-brown, more or less regularly granular. Such cells also occur in the periphery amongst the connective tissue and bile ducts. With Berliner Blue only a few granules of a yellow-brown colour seen in some of the liver cells, whereas the pigment cells in Enzootic Icterus is filled to bursting with yellow-brown granular pigment. In Bacterial Icterus the contour of liver cells can be made out, whereas these pigment cells of Enzootic Icterus are of entirely different nature, vary in size, and are more or less oval. In Bacterial Icterus the centre of the lobule is implicated in a necrobiosis; whereas the liver cells in Enzootic Icterus show an atrophy. There is fairly extensive desquamation and haemosiderosis of the stern cells in Bacterial Icterus, whereas this is reduced to practically nil in Enzootic Icterus.

Kidney: Many tubules and glomeruli close to the cortex with haemalum-eosin show the presence of reddish-pink homogeneous material. In places this stains slight brownish, i.e. haemoglobin with small amount of haemosiderin. With Berliner Blue two types of pigment, i.e. (*a*) Haemosiderin, (*b*) Haemoglobin. Very slight alterations in rest of kidney, i.e. in the parenchyma.

Spleen: Shows a large amount of blood in the sinuses. Very little lymphoid tissue seen, only accumulations here and there. Very little of the pulpa made out and consequently with Berliner Blue stain only remains of the pulpa can be shown up as result of the presence of haemosiderin.

Periportal Lymph Gland: Shows fair amount of desquamation of sinus cells with minute, yellowish-brown granular pigment, and with Berliner Blue some cells show that the pigment is haemosiderin.

Retropharyngeal Lymph Gland: With haemalum-eosin sinuses show numerous desquamated cells, containing brown pigment (golden tinge). With Sudan III, some cells filled with minute, brick-red fat droplets, whereas others contain golden-yellow pigment; some contain both. With Berliner Blue yellowish (golden) pigment in desquamated cells; no iron pigment present.

Mediastinal Lymph Gland: Same as above, but with Sudan III there are clusters of large cells which do not show intensive staining, but are of a light brownish colour. These accumulations are not only confined to the cortex, but also associated with the strands of lymphoid tissue in the medulla. These clusters contain about 15-20 cells lying together, the cells are spherical in outline and much larger than the ordinary desquamated endothelial cell. They contain a round spherical vesicular-looking nucleus.

SHEEP No. 13825.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 13.5.26. P.M. No. 5497. Spec. No. 5934. Merino Hamel. Aged. Condition good.	*Pathological Anatomical Diagnosis.*—Anaemia; generalized icterus; haemoglobinaemia; degeneration liver and myocard; tumour splenis; degeneration and pigmentation kidneys; multiple necrosis adipose tissue (peritoneal); slight constipation; oedema and pigmentation both lungs. *Etiological Diagnosis.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: Columns of liver cells for three-quarters of the lobule have become dissociated through loss of kitt substance; these cells are lighter stained, and seem to be larger than ordinary liver cells. They appear swollen. Majority of these cells show the nuclei affected with a necrobiosis, i.e. pyknosis and karyolysis (the latter to a less degree). The stroma in these parts is not clear and definite; stands out as a greyish, irregular network in which here and there erythrocytes can be made out. The zone of dislodged liver cells is marked off fairly sharply from intact columns around the periphery. With Sudan III the cells around the central vein show the presence of a large number of fat droplets; majority of these droplets are very minute, some are medium sized. These small fat droplets are only present to a small extent in the intact liver cells around the periphery. Absence of the large pigment cells seen in Enzootic Icterus. With Van Gieson it gives one the impression that there is collapse of the stroma around the vicinity of the central vein. *N.B.*—Note the complete absence, or otherwise, of pigment in the stern cells (one or two with haemosiderin) or in the liver cells. Glisson's capsule here and there shows slight increase of the number of bile ducts; round cells and eosinophiles are also present.

Kidney: Tubuli here and there show necrobiosis (pyknosis and karyolysis). In the blood vessels a fair amount of haemoglobin, staining an intense pink with eosin; also present in the lumen of the tubules. With Sudan III here and there a few tubules show a fine granular pigment. This fluid pigment substance with picric acid stains greenish-yellow colour. Two classes of pigment seen with Berliner Blue: (1) dirty light brown pigment present in the tubuli and vessels, i.e. haemoglobin, and (2) diffuse (iron) blue pigment in the renal epithelium and as a homogeneous substance in the tubules, i.e. haemosiderin.

Spleen: Shows numerous cells, as large as endothelials, which with Sudan III show the presence of numerous minute fat droplets, which stain an intense brick-red colour. Are these cells related to those which function as pigment cells? With Berliner Blue there is a most remarkable absence of haemosiderosis. It was thought that this was associated with the stain, but the same results obtained with Turnbull's blue. Haemosiderin crystals seen in the adventitia of the large blood vessels; fairly frequent here and there; Malpighian bodies insignificant, and they are encroached on by the sinuses extensively filled with blood.

Lung: Well marked oedema; with Sudan III cells with pigment granules present in large numbers. With Berliner Blue haemosiderin is shown to be present although somewhat indistinctly stained. The pigment is not infrequent and lies in the capillaries of the alveolar walls. It is intracellular.

Iliac Lymph Gland: Note the typical arrangement of lymphoid tissue, i.e. into follicles and strands. The stroma seems to predominate the picture in which a good number of lymphocytes, eosinophiles, and desquamated endothelials

can be identified. The eosinophiles stain brick-red with Sudan III, and the usual yellow-brown pigment is present in endothelials, but very sparse. No fat seen. No iron.

Retropharyngeal Lymph Gland: Lymphoid tissue not prominent endothelial cells prominent; numbers of these desquamated and have rounded themselves off. Some nuclei are smaller and pyknotic. Some of these cells show erythrophagocytosis (but with Berliner Blue note a few with brown granular pigment, and no iron). In the medulla, good deal of fibrin present in places; also a good few neutrophiles; the rest is made up of lymphoid tissue in which there are a good few eosinophiles. With Sudan III the gland show a large number of granular cells which stain a reddish-brown.

Periptortal Lymph Gland: Same as above, desquamated cells stand out more prominently. Some of these desquamated cells show the presence of haemosiderin granules.

Prescapular Lymph Gland: With Sudan III desquamated endothelials can be identified with a brownish granular pigment, which does not stain for iron.

Myocard: Slight fatty infiltration.

Blood.	R.C.	W.C.	L.	M.	N.	E.	B.
10.5.26.....	13	5,500	56	4	35	5	
11.5.26.....	11	11,900	10	2	88	—	
12.5.26.....	5·6	13,700	45	5	44	6	
13.5.26.....	—	—	34	5	59	2	

It will be seen that after the injection of Icterus Bacteria there is a temporary leucocytosis of the neutrophile type. On the 12.5.26 normoblasts seen.

Blood Smear: Slight anisocytosis; normoblasts.

Liver Smears: (1) Cells with erythrophagocytosis; many of these cells have a vacuolated appearance. These cells are like typical stern cells and monocytes.

Lung Smears: Cells of endothelial nature and vacuolated. Smear not satisfactory.

Retropharyngeal Lymph Gland Smears: (1) Lymphocytes (?) referred to above. (2) Lymphocytes and lymphoblasts (note nucleoli). (3) Monocytes. (4) Endothelials.

Bone Marrow: Note number of cells of the eosinophile group. Little regeneration evidence in connection with erythrocytes. Few neutrophiles.

Spleen Smears: *Neutrophiles*; good few lymphocytes, etc.; monocytes; endothelials.

Mediastinal Lymph Gland Smears: Neutrophiles, monocytes, lymphocytes, etc., endothelials. In this smear a cluster of three cells seen. They have a leptochromatic stained nucleus; their cytoplasm is connected by processes and build up a type of reticulum.

SHEEP No. 9119.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 20.5.26. P.M. No. 5610. Spec. No. 5949. Merino Hamel. 4 Tooth. Condition good.	*Pathological Anatomical Diagnosis.*—Adiposity; extensive anaemia; icterus; haemoglobineamia; haemoglobinuria; degeneration and pigmentation liver, kidneys, myocard, and lymph glands. Slight constipation; slight fibrous adhesions at seat of splenic attachment. Absence of spleen as a result of previous splenectomy. *Etiological Diagnosis.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: With haemalum-eosin a fairly large zone around the central vein completely marked off from the peripheral part, and shows regressive changes; the arrangements of columns are completely destroyed, the cells lie anyhow, some about twice as big as others, and appear swollen. The cells stain a lighter pink with eosin; in places the nuclei are present and in some cells two nuclei can be seen. In other cells there is pyknosis, karyorrhexis, and to a slight extent karyolysis. In part of this zone there is a number of neutrophiles present. Here and there in intracapillary spaces are stern cells

containing a yellow-brown pigment, which is slightly smaller than normal erythrocytes and appears to be remains of these. There are a good few of these present. In places around the peripheral vessels there is an infiltration of cellular elements, viz., round cells of which many are lymphocytes. With Sudan III the area around the central vein is well separated from the periphery, i.e. a light greyish-brown centre, and a reddish-brown periphery. In this the liver cells show along the periphery of their cytoplasm the presence of minute droplets of fat linearly arranged. In the central area the droplets of fat are only present to a small extent. The pigment in the stern cells stains yellowish-brown; no fat seen in them. Probably at this stage the dissociation of the erythrocyte is not so far advanced as in case of those cells in which fat droplets are present. With Berliner Blue the pigment in the stern cells stains dark diffuse blue (blobs). Except for this haemosiderin, no other pigment present. The picture is somewhat different in this case of splenectomy as compared with Splenectomy and Anaplasmosis cases, where there is more marked desquamation, and absence of extensive regressive changes. As compared with Enzootic Icterus, there is complete absence of the large pigmented reticulum cells.

Kidney: With haemalum-eosin here and there very slight karyolysis. In the glomeruli here and there cells with golden-brown pigment, and yellow-brown pigment in the tubuli. With Sudan III, tubuli have a brown colour, as result of very fine minute pigment granules; the granula of those cells in the glomeruli stain brown; just a few present, and probably drifted in with the blood. With Berliner Blue in places the tubuli contorti have a diffuse blue colour; in places in the lumen a diffuse bluish pigment present, with no particular form or shape. It presents a sort of network appearance.

Lungs: In the blood vessels a good deal of blood present and there are numerous cells with a yellow-brown pigment, granular in appearance, and gives one the impression that they are remains of erythrocytes. With Sudan III these pigment cells stand out prominently in the capillaries. Two types of pigment present: (1) greenish-brown granules, slightly smaller than erythrocytes, oval probably remains of these cells; (2) irregular, smaller granules lying between the above and staining with Sudan III a reddish-brick colour (see Plate VII). In some cells (1) predominates and in others (2). Do these cells, or some of them, originate in the lung? What do these Sudan III stained granules signify? Is this unmasked fat from the erythrocyte which has become metabolised? With Berliner Blue these cells stand out most prominently as pigment cells, in which haemosiderin is present. These cells would not all come from the liver when compared with the number present there. Probably they have been drained from other centres. The granules are: (1) large as (1) above and stain greenish-blue, (2) granules are smaller than (2) above, and stain intense blue. With Giemsa, the pigment in cells stains greenish-yellow, whereas the erythrocytes stain a light yellowish-pink. In places the pigment stains yellowish-brown; these two types of pigment may be present in the same cell. Note that Giemsa stains erythrocytes in endothelials totally different to the pigment in reticulum cells of Enzootic Icterus.

Adrenal: Nothing unusual.

Mesenteric Lymph Gland: Fair amount of lymphoid tissue with distinct follicles. Desquamated sinus cells with brownish pigment present. With Sudan III, sinus cells stain light greyish-brown colour. Some show the same type of pigment as seen in the lungs, except the yellowish-brown is much less in evidence, and more of brick-red pigment. With Berliner Blue only a very few cells contain iron.

Periportal Lymph Gland: Less lymphoid tissue, only represented along the periphery. Sinus cells much in evidence with a yellowish-brown, fine granular pigment, especially in the medulla. With Sudan III, some of this pigment stains intensely; a great number of sinus cells involved, some show more pigment granules than others; some granules more of a greenish-yellow colour. With Berliner Blue these cells stain intensely blue, and show up as minute haemosiderin granules. The cells are crowded with them. A comparison was made of the same focus with various stains and this is well depicted in Plates V and VI.

Retropharyngeal Lymph Gland: With Sudan III, three types of pigment granules identified in the sinus cells:—

(1) Intense brick-red granules.
(2) Brick-red, granules fewer and larger.
(3) Yellow-brown, irregular, more circular granules, some may be remains of erythrocytes.

Blood and Organ Smears: This animal was still showing presence of Anaplasma, although not frequent, when it was inoculated with Bacteria

(Icterus) on 17th May, 1926. From then onwards the blood picture was more or less as follows:—

	Red Count.	White Count.	L.	M.	N.	E.	B.
17.5.26.....	7·3	15,900	56	3	39	2	
18.5.26.....	7·9	16,500	—	—	—	—	
19.5.26.....	4·9	14,000	22	—	78	—	
20.5.26.....	1·4	15,200	50	8	42	—	

It will be seen that there was a decided reduction in the number of the erythrocytes after the injection of the Bacteria. The differential count showed a neutrophile leucocytosis immediately after the inoculation, but the return to normal occurred soon afterwards.

Blood from the vena cava caudalis showed numerous monocytes with erythrophagocytes, some with vacuoles; stern cells as such were also identified, besides liver cells. Blood from the aorta showed more or less the picture seen in connection with jugular blood. Difficulty was experienced in differentiating between monocytes and lymphocytes. The blood smear revealed normoblasts and anisocytosis. Remember that this was a case of Bacterial Icterus in a splenectomised sheep.

Liver Smears revealed the following cells:—

(1) *Stern cells.*—These show erythrophagocytosis, and in their cytoplasm the remains of erythrocytes can be identified from recently ingested cells (which have retained their contour, but stain less intensely) to pigment masses of different sizes, and different staining intensity, and finally to mere vacuoles. The nucleus is irregularly shaped. Those in the picture are irregularly quadrilateral. These cells are even larger than the liver cells to be described.

(2) *Lymphocytes or Monocytes* (?).—Those with erythrophagocytosis. They are much smaller than the stern cells, some only the size of medium-sized lymphocytes (see Plate II). Some of these cells without the presence of the phagocyted erythrocytes, will be distinctly difficult to differentiate from lymphocytes. As was pointed out in the paper of De Kock and Quinlan (1) a differentiation was sometimes almost impossible, when these cells were encountered in the blood.

(3) *Lymphocytes.*

(4) *Plasma cells* (?).—Cells of the size and shape of lymphocytes, showing an intensely stained basophile cytoplasm with the nucleus eccentrically situated. The nucleus shows an intensely stained chromatin mass with a mulberry-like arrangement. Are these plasma cells? They were encountered from time to time in the blood of sheep (Plate II).

(5) *Neutrophiles*: fairly frequent.

(6) *Free nuclei*: chiefly of liver cells.

Lung Smears:

(1) *Endothelials* (?) (See Plate I A.)—Alveolar or vascular endothelium shows a large amount of granular cytoplasm, with their margins indistinctly marked off, and a small round nucleus. It will be seen that these cells are totally different from: (2) *Desquamated endothelials* (see Plate I), showing various stages of erythrophagocytosis, resembling closely those cells described in the liver as stern cells. In the cytoplasm of these, phagocyted erythrocytes can be seen in all stages of metabolism from those of the normal size to mere pigment granules and vacuoles. They vary in size from very large cells to those which resemble large monocytes with erythrophagocytosis described in the blood.

In the section from the lung, and stained in various ways, the following were noted:—

(i) With Berliner Blue the phagocyted erythrocyte was in the form of bluish blobs. That means that the haemoglobin of the engulfed erythrocyte had been converted into haemosiderin.

(ii) With Giemsa the contour of these erythrocytes could be made out, and gave more or less the same hue as encountered in the lung smears.

(iii) With Sudan III besides the yellow-brown pigment granules of the size and contour of erythrocytes, there are also fat droplets. The question arises where did these cells originate?

(3) *Lymphocytes* or *Monocytes* (?). (See Plate II): Some like monocytes with erythrophagocytosis, but others were of size and shape which made it difficult to differentiate them from lymphocytes, if it was not for the presence of the phagocyted cells.
(4) *Lymphocytes.*
(5) *Plasma cells* (?) (See Plate I.) As described in the liver.
(6) *Neutrophiles.*
(7) *Eosinophiles.*

Bone Marrow Smears:—
(1) Eosinophile group very prolific.
(2) Fair amount of regeneration of red cells.
(3) Monocytes.
(4) Numerous myeloblasts. Cells somewhat resembling myeloblasts, even as regards their nucleoli, have been seen in other positions. They are perhaps not so large, and their cytoplasm is not stained so intensely blue.

Kidney Smears:—
(1) *Free nuclei* and *epithelial* cells with small regular granules.
(2) *Monocytes*: one seen with erythrophagocytosis.
(3) *Neutrophiles*: a fair number.

Periportal Lymph Gland Smears:
(1) *Lymphocytes* or *Monocytes* (?). (See Plate I.)—With intensely dark reddish-purple granules. Some of these granules are fairly large and triangular in shape. The character of the nuclei of these cells and their cytoplasm resembles more that of monocytes, but it is distinctly difficult to say definitely. Such cells with these granules also seen in the blood.
(2) *Plasma cells* (?) Same as seen in liver.
(3) *Lymphocytes* and *lymphoblasts.* Note some large cells, with intensely blue stained cytoplasm and monocytic-like nucleus, encountered also in the blood.
(4) *Neutrophiles.*
(5) *Eosinophiles*—rare.

Mediastinal Lymph Gland Smears:
(1) Endothelials with vacuoles in cytoplasm, a type of cell resembling stern cells.
(2) Monocytes.
(3) Lymphocytes, etc.

Mesenteric Lymph Gland Smears:
(1) Several cells showing degeneration, some with completely broken down nuclei, in small chromatin particles.

Retropharyngeal Lymph Gland Smears:
(1) Note one large endothelial showing marked erythrophagocytosis. As regards the character of the nucleus (round) and the amount of cytoplasm, this type of cell is more like an endothelial than of the nature of cells seen in the lung and liver. Does that mean that the cells in the lung are stern cells which have drifted into the liver? That means that no erythrophagocytosis takes place in the lung, but is present in lymph glands.
(2) Broken down nuclei in degenerated cells also seen.

SHEEP No. 10791.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 13.2.26. P.M. No. 5290. Spec. No. 5757. Merino Hamel. Condition good.	*Blood.*—Not coagulated, somewhat watery; brownish tinge; coagulates on standing. *Subcutaneous Connective Tissue.*—Medial aspect of the right hind limb (thigh) shows the blood vessels distended, giving the tissue a reddish colour over an area, about the size of the hand. There is a certain amount of infiltration with a serous fluid, and here and there petechiae present. *Mucous Membranes.*—Pale with a tinge of yellow. *Peritoneal Cavity.*—Large amount of fat of a canary-yellow colour. *Lymph Glands.*—Moist and have a reddish-brown colour. *Liver.*—Much enlarged; light reddish-brown colour, almost chocolate. On section lobulation distinct, and shows well marked brownish pigmentation around central vein.

SHEEP No. 10791—*continued.*

Particulars of P.M.	*Macroscopical Changes.*
	Kidneys.—Swollen; through the fibrous capsule they present a reddish-grey appearance; on section are dark in colour, zones distinct. Cortex dark reddish-brown, the medulla reddish-pink; cortex shows dark reddish striations. *Small Intestine.*—Mucous membrane is brown throughout. *Caecum.*—Small amount of a somewhat firm faeces. *Colon* ditto. *Bladder.*—A quantity of blood stained urine; in places blood coagula present. *Pathological Anatomical Diagnosis.*—General icterus; anaemia; haemoglobinaemia; haemoglobinuria; slight oedema and pigmentation lungs; extensive pigmentation and slight degeneration kidneys; hyperaemia and pigmentation lympathic glands; constipation; acute catarrhal gastro-enteritis; blood coagula and pigmentation large intestine and small intestine. *Etiology.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: Slight round cellular infiltration in the periphery; dissociation of the columns of liver cells around the central veins with necrobiosis, and altered eosin staining of the cytoplasm. Fair number of medium-sized droplets of fat in and out of liver cells, especially in vicinity of central veins. With Berliner Blue fairly extensive desquamation of stern cells with haemosiderosis.

Kidneys: Show very little impairment of the epithelium. In the lumen of a number of tubules, there is haemoglobin, and some of this has become partially changed into haemosiderin (dark brown).

Lymph Gland: (1) With haemalum-eosin extensive desquamation of sinus cells, which become spherical and show granular brown pigment. Some of these cells are very large. With Berliner Blue some cells with iron pigment, but these are few; the majority contain a yellow-brown granular pigment. With Sudan III majority of cells show brick-red granular pigment. This is very extensive, especially in the marginal sinuses.

(2) Ditto, but sinuses much widened with these cells, especially towards the hilus.

(3) Ditto.

Intestines, *Adrenals*: No lesions.

Liver Smears: Liver cells, stern cells with erythrophagocytosis. Neutrophiles, lymphocytes, endothelials with oval nuclei. Are the latter associated with endothelials of the blood vessels?

Lung Smears: Endothelials with erythrophagocytosis, some with vacuoles; neutrophiles, lymphocytes, few erythrocytes, desquamated endothelials vacuolated. There are also cells of endothelial nature, probably derived from the alveoli.

Spleen Smears: Neutrophiles in fair numbers. Endothelials with erythrophagocytosis, like stern cells in character. Some with vacuoles, others without. Lymphocytes, monocytes.

Bone Marrow Smears: Number of cells of the eosinophile group.

Jugular Blood Smears: Monocytes, neutrophiles, lymphocytes, eosinophiles, monocytes with vacuoles, anisocytosis, polychromasia, normoblasts.

Vena Cava Blood Smears: Endothelials with erythrophagocytosis; monocytes.

SHEEP No. 9305.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 6.3.26. (Died during the night.) P.M. No. 5344. Spec. No. 5802. Merino Hamel. Condition fair.	*Blood.*—Pale reddish-brown, watery, stains badly. *Liver.*—Orange-brown on section. *Kidneys.*—On section dark reddish-brown. *Caecum and Colon.*—Contents rather dry. *Bladder.*—Contains small amount dark red urine. *Pathological Anatomical Diagnosis.*—Extensive general icterus; haemoglobinuria; haemoglobinaemia; tumour splenis; pigmentation liver and kidneys; hyperaemia and oedema of lungs. *Etiology.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: The cells of some lobuli show marked changes, i.e. altered staining of cytoplasm, and the nucleus in various stages of necrobiosis. Chiefly the centre of the lobule affected, and in places extends over the whole lobule. In between these liver cells are erythrocytes which stain well. It is most difficult to say whether autolysis is also involved in this section. With Sudan III globules are present in the form of small droplets arranged along the periphery of the cells, in the healthy portion of the liver, i.e., in the periphery. In Glisson's capsule here and there vessels distended with blood; there is a slight round cell infiltration, proliferation of bile-duct epithelium and extravascular are large, spherical cells with a small vesicular nucleus situated at the one pole. The cytoplasm with haemalum-eosin is light brown. As regards the nature of these cells, they are most probably reticulum cells. With Berliner Blue, only here and there a desquamated stern cell in the lobule. Note absence of pigment in these liver sections.

Kidney: Many of the tubuli show presence of haemosiderin granules, but to small extent only. With haemalum-eosin autolysis fairly evident. (*N.B.*—Be careful about the interpretation of lesions in the liver.)

Myocard: Well marked fatty changes, practically all fibres involved; probably autolysis also present.

Spleen: Absence of usual pigmentation; atrophy of lymphoid tissue. Marked amount of blood in blood spaces.

SHEEP No. 9213.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 29.9.26. P.M. No. 5918. Spec. No. 6296. Merino Hamel. Full mouth. Condition poor.	*Mucous Membranes.*—Pale yellow colour. *Blood.*—Watery with light brownish hue. Does not stain well. *Adipose Tissue.*—Intense yellow colour. *Liver.*—Swollen, on section brownish-red, watery fluid from cut surface; lobulation distinct; cut surface has an intense yellow green colour, consistence friable. *Kidneys.*—Fair amount of yellow fat in the capsule; fibrous capsula easily detached and leaves smooth reddish-brown surface; cortex greyish-brown and the medulla pinkish-yellow. Consistence friable. *Bladder.*—Contracted, about 3 c.c. clear yellow urine present. *Large Intestine.*—Hard dark brown faeces present distending the caecum and ansa proximalis; mucous membrane reddish colour. *Pathological Anatomical Diagnosis.*—Marked general icterus; subcutaneous haemorrhages; hydropericardium; degeneration myocardium; oedema of the lungs; pigmentation liver; tumour splenis; constipation in caecum and ansa proximalis; slight acute catarrhal enteritis. *Etiology.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: With haemalum-eosin columns of liver cells around the central veins altered; about half the lobule around central vein shows extensive degeneration, and in part loss of liver cells. The fatty changes in the cytoplasm vary from small droplets of fat (with Sudan III) to large droplets. The cells around the periphery appear intact, and here the columns fairly well retained; this part shows practically no fat changes. The small bile-ducts are markedly distended with greenish-yellow homogeneous pigment and stand out as a distinct network. With Berliner Blue fairly well marked haemosiderosis present in the stern cells.

Kidneys: With Berliner Blue, fairly extensive dark blue pigmentation associated with the interstitium, irregularly scattered in the cortex, and appears to be associated with endothelials; diffuse haemosiderosis in epithelium of the convoluted tubules. With Sudan III the pigment masses stand out in the interstitium as cell masses filled with a dirty, yellow-green pigment, and these masses are associated with a localized lymphocytic interstitial nephritis. In the lumen of some tubules, there are evidences of haemoglobin.

Spleen: Very extensive haemosiderosis (more than normal) associated with the Reticulo-endothelial cells of the pulpa.

Lungs: Desquamated endothelials with extensive haemosiderosis in the capillaries, and stand out as a network.

Lymph Gland: Slight haemosiderosis in the endothelials of the sinuses (medulla) in places, not diffuse. When stained with Sudan III the sinus cells show fairly extensive pigmentation, i.e. yellowish-brown granules and interspersed between them brick-red droplets.

SHEEP No. 10225.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 13.2.26. P.M. No. 5291. Spec. No. 5758. Merino Hamel. Condition fair.	*Blood.*—Not coagulated, stains well. *Adipose Tissue.*—Of normal colour and consistence. *Liver.*—Slightly swollen; reddish-brown colour. Through the capsule the lobulation appears quite distinct. On section it is found that the pigment lies mainly around the central vein, and is fairly extensive; consistence softer and more friable. *Kidneys.*—On section zones not distinct, consistence somewhat softer. *Small Intestine.*—Bile stained and slightly swollen. *Bladder.*—Small amount of blood stained urine present. *Pathological Anatomical Diagnosis.*—Anaemia; haemoglobinuria; pigmentation and degeneration liver; tumour splenis; oedema of lungs and multiple small abscesses present; slight constipation. *Etiology.*—Bacterial Icterus. Killed by chloroform for collection of material.

MICROSCOPICAL CHANGES.

Liver: Hyperaemia. There are three circumscribed foci, about quarter of the diameter of a lobule, situated at the periphery and made up of proliferated bile-duct epithelium, supported by connective tissue (like bile-duct adenoma); associated with these are large pigment cells. With Berliner Blue bile-duct stasis in the lobule, and a fair proliferation of stern cells containing haemosiderin. Slight fatty infiltration, many droplets lying free. Some liver cells also show a brownish granular pigment. There is no evidence of necrosis.

Kidneys: Show little haemoglobin, but well marked haemosiderosis in the cortex; the colour varying from light to a dark blue, and the formation of typical haemosiderin granules in the epithelium. Blood vessels distended. Some of the epithelium of the tubules show hyaline droplet formation.

Adrenals: Hyperaemia. Here and there are cells containing haemosiderin granules.

Lung: Area of broncho-pneumonia and in the unaffected portion a network of cells with haemosiderosis detected.

Myocardium: Fairly numerous Sarcosporidia. One small focus of round-cell infiltration. Very slight fatty infiltration in the fibres.

Lymph Gland: (1) Desquamation of sinus cells in the medulla (see Plate VII). With Berliner Blue here and there a cell with haemosiderin, but with Sudan III the majority of desquamated sinus cells show the presence of minute granules, staining a dark brick-red. It does not seem to be lipoids, because alcohol does not produce vacuolation. Is this associated with breaking up of erythrocytes and what is its nature?

(2) With haemalum-eosin shows the typical, large pigment cell which has also been described in the liver in cases of Enzootic Icterus. These are specially associated with the lymphoid tissue of the medulla, and gives one the impression that these cells originate in the medulla. They do not occur in the marginal sinuses. They appear to be reticulum cells, much larger than any of the leucocytes, and filled with a brownish granular pigment. This pigment is not iron, but as in the liver, stains a yellow-brown. It has just been shown in later experiments that sheep arrive here from the Karroo area with the reticular system partly affected with this peculiar pigmentation referred to above. This may easily be confused for lesions in other diseases, e.g. as was actually done in this case.

(3) Same as second. The cells not so large.

Intestine (Small): Shows encapsuled haemorrhages in the muscular layer, perhaps associated with oesophagostomiasis.

Intestine (Large): Same as the above, except in this case these foci situated in the submucosa.

Liver Smears: (1) *Liver cells*, some vacuolated.

(2) *Some liver cells* with bile canaliculi present, lying as casts across the cell.

(3) *Monocytes*: fair number.

Lung Smears: *Endothelials*, some with pigment, others vacuolated.
Spleen Smears: Monocytes, eosinophiles, lymphocytes, neutrophiles. Frequent erythrophagocytosis in cells of large dimension, resembling stern cells, with and without pigment granules and vacuoles.
Bone Marrow: Numerous cells of eosinophile group.

SHEEP No. 14421.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 9.2.25. P.M. No. 5279. Spec. No. 5747. Merino Hamel. Condition moderately fair.	Died during the night. *Adipose Tissue.*—Fat canary-yellow colour. *Subcutaneous Tissue.*—Here and there seeds and plumes of Heteropogon. These seeds also encountered below the cutaneous muscle. Medial aspect of the thigh of left limb shows extensive yellowish semi-fluid material infiltrated into the tissue spaces. The underlying muscles and tissues show reddish areas and cavities filled with a fibrino-purulent material. *Liver.*—Light grey to dark greenish colour, but post-mortem changes advanced. *Kidneys.*—Stained light yellow colour, but too decomposed. *Colon.*—Ansa proximalis shows the presence of some hard faeces; and adult oesophagostomum. *Pathological Anatomical Diagnosis.*—General Icterus and anaemia; deep localized haemorrhagic fibrino-purulent dermatitis and myositis; oedema of the lungs; tumour splenis; localized fat necrosis of adipose tissue of peritoneum and pleura; slight constipation; parasitic nodules in small and large intestines; adult oesophagostomum in large intestines; heteropogon seeds in skin and subcutaneous tissue. *Etiology.*—Bacterial Icterus (natural case).

MICROSCOPICAL CHANGES.

Liver: Autolysis fairly advanced, but there is an indication of necrobiosis around the central veins. Here and there in the intralobular capillaries a good number of neutrophiles present. A fair number of cells show presence of fat droplets. The desquamated pigment cells of Enzootic Icterus not present.
Kidneys: Autolysis fairly advanced.
Mediastinal Lymph Gland: Note the large number of pigment cells, more frequent in the medulla. This pigment does not seem to be associated with haemosiderin. These cells show up more distinctly with Sudan III, i.e. the granules seem to be of a fatty nature.

SHEEP No. 13980.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 13.1.26. P.M. No. 5289. Spec. No. 5755. Merino Hamel. Condition good.	*Blood.*—Dark red, partly coagulated, stains badly. *Adipose Tissue.*—Pale yellow. *Liver.*—Colour varies from blue to brown but marred by extensive post-mortem changes. *Kidneys.*—Greenish-brown, medulla pale brown. *Bladder.*—Faint dark red urine, which is slightly turbid. *Pathological Anatomical Diagnosis.*—General icterus; haemoglobinuria; slight hydropericardium; ecchymoses left endocardium, slight hyperaemia and emphysema of lungs; extensive tumour splenis; pigmentation kidneys. *Etiology.*—Bacterial Icterus.

MICROSCOPICAL APPEARANCES.

Liver: Autolysis present. Interstitial hepatitis, i.e. Glisson's capsule infiltrated with round cells and few neutrophiles, and with Sudan III, some of the cellular elements in the periphery are packed with granules which appear to be of a fatty nature; the cells seem to be of the mononuclear type. Similar fine, irregularly granular pigment, present in the liver cells. With Berliner Blue here and there within the lobule, desquamated stern cells, within which iron pigment can be made out. In spite of the autolysis, the column of liver cells well retained and no evidence of central necrosis.

SHEEP No. 14312.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 10.3.26. P.M. No. 5354. Spec. No. 5812. Merino Hamel. Condition good.	*Blood.*—Watery, reddish-brown, stains badly. *Adipose Tissue.*—Stains a canary yellow colour. *Liver.*—Reddish-brown; on section somewhat paler, centre of lobule shows slight reddish-brown pigment. *Kidneys.*—Fat in fat capsula stains canary yellow; on section the medulla is pale yellow, whereas the cortex is pale brown, i.e., zones distinct. *Caecum and Colon.*—Contents brown and very dry; parasitic nodules frequent. *Pathological Anatomical Diagnosis.*—General icterus; hydropericardium; petechiae epicardium; hyperaemia lungs; atelectasis left lung; pneumonia right lung; pigmentation liver; slight pigmentation kidneys; tumour splenis; parasitic nodules in large intestines. *Etiology.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: Central veins distended, and contain erythrocytes, neutrophiles, and desquamated stern cells, with erythrophagocytosis and other round cells. Around the central vein liver cells are light pink, and their nuclei are in various phases of necrobiosis; also good few neutrophiles present there. Periphery shows proliferation of bile-duct epithelium and blood vessels distended. In the intralobular capillaries, there is in places a fair number of desquamated stern cells, with haemosiderosis. Fatty degeneration in the form of very minute droplets and almost all the liver cells are involved.

Kidney: No pigment seen with Berliner Blue, but with haemalum-eosin autolysis detected. Some of the tubuli contorti show presence of minute fat droplets.

Lung: Lesions of Jaagsiekte present. Here and there the epithelium shows the presence of fatty changes, but very slight, only a few cells affected. Here and there a few cells show presence of haemosiderin granules. The epithelium also shows presence of haemosiderin.

Myocard: No lesions.

Intestine (Small): Shows the propria infiltrated with numbers of eosinophiles. No abnormal pigmentation seen.

Spleen: Blood vessels distended with blood, especially the sinuses overshadowing the presence of follicles and lymphoid tissue; extensive pigmentation in the form of brown granular pigment, affecting the cells of the reticuloendothelial apparatus. With Berliner Blue haemosiderin detected in practically every part of the spleen, except the follicles and rest of lymphoid tissue. This haemosiderosis is pathological for the sheep, being more extensive than described in cases where there is the usual destruction of erythrocytes. Does this stand in any relation to the absence of pigment in the kidney? Is this extensive haemosiderosis in the spleen and partly in the liver, the result of no pigmentation in the kidneys? Why is it that in some cases the spleen functions abnormally with no lesions in kidneys and in other cases, the reverse sets in?

Lymphatic Glands: Blood vessels distended with blood. The medulla shows erythrophagocytosis here and there. Besides there is desquamation of sinus cells. These are found as large spherical cells free in the sinuses. There are a good many polymorphs present, some are neutrophiles and others are eosinophiles. With Sudan III, a great number of sinus cells can be made out. Their pigment is of a fatty nature and in the forms of small droplets. The cells are large and contain nuclei of endothelial character. With Berliner Blue iron seen, but the granules assume a yellow-brown colour.

SHEEP No. 13847.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 21.2.26. P.M. No. 5323. Spec. No. 5774. Merino Hamel. Condition fair.	*Adipose Tissue.*—Pale yellow. *Blood.*—Light reddish-brown, very watery, stains badly. *Liver.*—Cut surface has a mottled appearance due to many minute light red areas of the size of a pin's point. Rest of the liver substance has a reddish brown colour. *Gall Bladder.*—Dark green, viscid bile. *Kidneys.*—Cortex dark reddish-brown whereas the medulla is pale brown. *Small Intestine.*—Pale greenish-yellow. *Large Intestine.*—Caecum and large colon greenish-yellow; rather dry contents present. *Etiology.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: Shows fairly extensive necrobiosis, chiefly associated with the centre of the lobule. The necrotic areas are identified by lighter colour of the cytoplasm and necrobiosis. Associated with these foci is a number of neutrophiles. With Berliner Blue marked desquamation of stern cells and haemosiderosis. With Sudan III, fatty degeneration almost general in the form of numerous granules. With Gram and Giemsa stains no bacteria seen in these foci.

Kidney: A few convoluted tubules here and there show presence of minute fat droplets, also present in some of straight tubuli. Complete absence of iron pigment.

Myocard: Shows fairly extensive fatty infiltrations.

Lymph Gland: No. 1. Hyperaemia. With Sudan III numerous sinus cells in periphery and medulla and they show the presence of minute fat droplets. These cells lie free. With Berliner Blue no definite cells with iron pigment seen, but a number of sinus cells shows light yellowish-brown granules.

No. 2. In the second gland, these fatty changes affecting the sinus cells are more extensive. With haemalum-eosin a number of eosinophiles seen in sinuses and also in medulla.

Lungs: Hyperaemia and at frequent intervals within the alveolar wall there are endothelial cells containing a brown pigment (granular) which is haemosiderin. These cells form a bluish network.

Spleen: Very extensive haemosiderosis, affecting the greater portion of the tissue; almost the whole pulpa involved. With haemalum-eosin good amount of blood in the sinuses. Lymphoid follicles stand out sharply and not affected with this pigment.

SHEEP No. 10731.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 13.2.26. P.M. No. 5288. Spec. No. 5756. Merino Hamel. Condition fairly good.	Died during the night. *Adipose Tissue.*—Fair amount of fat of a slight yellow colour. *Liver.*—Enlarged; borders rounded. On section indistinct brownish-yellow colour. Soft and friable in consistence. *Kidneys.*—Surface of the kidneys after removal of the fibrous capsula is bluish red; on section zones not distinct; cortex bluish-brown colour, striated, whereas the medulla is dark bluish-red. Very friable. *Small Intestine.*—Yellowish mucous membrane and from it a thick yellow mucous-like material can be scraped off. *Large Intestine.*—Dark green contents; mucous membrane slate-bluish colour. *Pathological Anatomical Diagnosis.*—Generalized cyanoses; slight general icterus; dilatation of heart (right and left); degeneration of myocardium; nodules in lungs; marked broncho-pneumonia; marked tumour splenis; degeneration and pigmentation liver and kidneys; extensive pigmentation mucous membranes of intestines; parasitic nodules intestines. *Etiology.*—Bacterial Icterus complicated with pneumonia.

MICROSCOPICAL CHANGES.

Liver: Blood vessels distended with blood and stand out as a prominent network. Slight interstitial hepatitis, majority of liver cells vacuolated; some

of these vacuolated cells do not show the presence of nuclei. With Sudan III the vacuoles are still there, but probably this was filled with droplets of fat now lying free in the section.

Kidney: Hyperaemia; tubules show necrosis complicated with autolysis; granular fatty substance present in the epithelium. Absence of iron pigment.

SHEEP No. 13989.

Particulars of P.M.	*Macroscopical Changes.*
P.M. on 18.2.26. P.M. No. 5313. Spec. No. 5765. Merino Hamel. Condition fair.	*Mucous membranes.*—Pale yellow. *Blood.*—Not coagulated (although rigor mortis present); pale reddish-brown; watery but stains fairly well. *Flesh.*—Pale reddish-brown. *Liver.*—Yellowish-brown; on section colour orange-brown; lobulation fairly distinct; consistence nothing usual. *Kidney.*—On section greenish-brown; cut surface transparent. P.M. changes present. *Bladder.*—Contains a fair quantity of a dark red urine which is slightly turbid. *Pathological Anatomical Diagnosis.*—General icterus; anaemia; haemoglobinuria; haemoglobinaemia; marked tumour splenis; pigmentation liver and kidneys; hyperaemia and oedema of lungs; petechiae epicardium. *Etiology.*—Bacterial Icterus.

MICROSCOPICAL CHANGES.

Liver: With Sudan III shows Glisson's capsule standing out prominently, due to an increase of fibrillae, and to a less extent cellular elements. In it are cells filled with a light brown granular pigment. The liver cells, besides definite fat droplets, here and there show a light brownish granular pigment. In places around the central veins, the columns of liver cells are somewhat broken down and show slight karyolysis and autolysis. With Berliner Blue here and there a desquamated stern cell with granules.

Lungs: Hyperaemia and oedema; again note the frequence of iron pigment in cells associated with the vessels of the alveolar walls.

Kidneys: Autolysis. *N.B.*—Absence of iron pigment.

EXPLANATION OF PLATES.

PLATE I.

STUDY OF LYMPHOCYTES AND PLASMA CELLS.

Fig. 1. Sheep 13853. Giemsa. Note erythrophagocytosis in circulating blood from jugular. The nuclei of these cells are of the nature of lymphocytes. Note the different staining reaction of the "engulfed erythrocytes."

Fig. 2. Sheep 9119. Giemsa. Organ smears from liver. Note erythrophagocytosis. The nucleus of the cell is of the nature of a lymphocyte.

Fig. 3. Sheep 9119. Giemsa. Organ smear from periportal lymph gland. Note the chromatin stained masses in a cell of the nature of a lymphocyte.

Fig. 4. Sheep 9119. Giemsa. Organ smears from liver. Note the pigment particles in a cell whose nucleus is of the nature of a lymphocyte.

Fig. 5. Sheep 10511. Giemsa. Smear from blood, jugular. Probably large lymphocyte, but difficult to differentiate definitely from endothelial.

Fig. 6. Sheep 10511. Giemsa. Smear from blood, jugular. Further types of lymphocytes, which may easily be classified as endothelials.

Fig. 7. Sheep 10511. Giemsa. Smear from blood, jugular. One lymphocyte and one cell classified as a plasma cell.

Fig. 8. Sheep 10511. Giemsa. Smear from blood, jugular. Cell classified as a plasma cell.

PLATE II.

STUDY OF ENDOTHELIALS AND MONOCYTES.

Fig. 1. Sheep 9119. Organ smear from liver. Giemsa. Stern cells showing erythrophagocytosis and presence of vacuoles.

Fig. 2. Sheep 13853. Smear from bone marrow. Giemsa. R.E. cells showing erythrophagocytosis and presence of pigment granules and vacuoles.

Fig 3. Sheep 9119. Organ smear from lung. Giemsa. Note erythrophagocytosis.
Fig. 4. Sheep 9119. Giemsa. Endothelial in circulating blood showing erythrophagocytosis.
Fig. 5. Sheep 10511. Giemsa. Endothelial in circulating blood from jugular.
Fig. 6. Sheep 16023. Giemsa. "Transitional" and neutrophile in circulating blood from jugular.

PLATE III.

Study of Endothelials.

Fig 1. Sheep 13853. Giemsa. Bone marrow smears. Note erythrophagocytosis in a cell which, as regards its nucleus, nucleoli, and cytoplasm, resembles a myeloblast, but probably this cell is a R.E. cell.
Fig. 2. Sheep 13853. Giemsa. Organ smear from liver. Note erythrophagocytosis, probably a stern cell.
Fig. 3. Sheep 13853. Giemsa. Organ smear from liver. Probably same as Fig. 2, but note the difference in the size of these two cells.
Fig. 4. Sheep 13853. Giemsa. Organ smear from haemal lymph gland. Probably endothelial.
Fig. 5. Sheep 13853. Giemsa. Organ smear from a lymph gland. Probably of the same nature as cells in Figs. 1 and 2.

PLATE IV.

Study in the Disintegration of Phagocyted Erythrocytes.

Fig. 1. Sheep 9119. Giemsa. Organ smears from lung. Note the erythrophagocytosis in endothelials.
Figs. 2 and 3. Sheep 9119. Section of a lung. Berliner blue stain. Cells showing haemosiderosis—remains of engulfed erythrocytes—individual cells drawn under high magnification.
Figs. 4 and 5. Sheep 9119. Section of same lung as Figs. 2 and 3. Sudan III. Haemalum stain. Note remains of engulfed erythrocytes and presence of fat droplets in endothelials.
Figs. 6 and 7. Sheep 9119. Section of same lung as Figs. 2 and 3. Giemsa. Note the engulfed erythrocytes.

PLATE V.

Study of the R.E. Cells and Reticular Cells.

Figs. 1 and 2. Section of a lymph gland. Sudan III. Contrast the pigment cells (reticulum cells) situated in the lymphoid tissue with the sinus cell (R.E. cells).
Fig. 3. Specimen 6208. Section of a liver. Berliner blue stain. Note the nature of the pigment and the distribution of the reticulum cells in the periphery of the liver lobule.
Fig. 4. Section of a lymph gland. Berliner blue stain. Compare with Figs. 1 and 2, and contrast the function of the sinus cells in this section which shows marked haemosiderosis.

PLATE VI.

Further Study of the Reticular Cells.

Fig. 1. Sheep 14708. High magnification of a reticular cell seen in the Glisson's capsule. Sudan III.
Fig. 2. Specimen 6221. Section of a mediastinal lymph gland. Sudan III. Note the distribution of sinus cell, pigmented reticulum cell, and eosinophile. Contrast the staining characters of these cells.
Fig. 3. High magnification of the cells referred to in Fig. 2. Note the difference in size. The reticulum cell is the largest, whereas the sinus cell shows a slight diffuse haemosiderosis and other pigment granules. Note the nature of the eosinophile granules with this stain.
Fig. 4. Organ smears from prescapular lymph gland. Giemsa. Reticulum cell. Note the distribution of the nucleus and the character of the cytoplasm with this stain.
Fig. 5. Sheep 14922. Organ smears from liver. Giemsa. c.f. Fig. 4.
Fig. 6. Sheep 15160. Organ smears from lung. c.f. Figs. 4 and 5.