THE HISTOLOGY OF A CASE OF ANAPHYLACTIC SHOCK OCCURRING IN A MAN.*

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(PLATES XVI., XVII.).

DESCRIPTION OF CASE.

THE patient, a soldier aged 22, was wounded in the back and right shoulder by shrapnel on 30th March 1917.

The only serious damage was a laceration of the right kidney. This was successfully treated. He received prophylactic injections on 30th March, 4th April and 20th April. No symptoms were produced by the second and third injections. On 2nd May, about eleven o'clock, he was given his fourth dose of serum, 500 units. Almost immediately he called out that he felt very ill. He became cyanosed, and began to vomit. The cyanosis increased, breathing became difficult, there was a thick secretion of tenacious mucus in the upper respiratory passages, the pulse could not be felt. Ether was injected. Hot cloths and massage were applied to the precordial area. Artificial respiration was performed for about twenty minutes. The lips and eyelids were œdematous. After twenty minutes respiration commenced, and continued for about an hour. During this period no heart action could be detected. He died at ten minutes past twelve.

The post-mortem was made during the afternoon of the same day. The body was that of a well-nourished and well-developed young man. There was no cyanosis or œdema at the time of the post-mortem examination. Over the back of the right loin was an incision which had almost completely healed, but had broken down at one point where a few drops of blood had exuded. Over the right hypochondrium was a small superficial scar, about 1 in. by 1 in., brownish in appearance, and probably the result of a superficial burn.

The Brain weighed 49 oz. The superficial veins were engorged, but no other change was noted in the brain and membranes. There was no excess of fluid in the ventricles or subarachnoid space.

Mouth and Neck.—The tonsils were enlarged. The œsophagus was normal. The larynx and trachea were congested, and contained a large quantity of tenacious mucus. The lymphatic glands of the neck were enlarged, pale and soft.

Thorax.—The pericardium contained about an ounce of clear fluid. The heart weighed 12½ oz. The heart muscle, valves, and the great vessels were normal. There was no trace of thymus tissue.

The right lung weighed 13 oz., the left lung 10½ oz. Except for some slight congestion of the posterior part of the lower lobes, the lungs were normal in appearance. There were numerous enlarged glands in the mediastinum; these were soft and pale.

Abdomen.—The stomach and intestines were normal. The liver weighed 62 oz., had a deep purplish-red colour, and appeared to contain an excess of blood. The spleen weighed $9\frac{1}{2}$ oz. and was soft. The Malpighian corpuscles were very prominent. The suprarenal glands and pancreas were normal. The left kidney, ureters, the bladder, the prostate and the testes were normal. The right kidney was firmly united by adhesions to the posterior abdominal wall. The kidney had been lacerated on its posterior aspect, but the laceration had completely healed. A large clot of blood, capsuled by fibrous tissue, and evidently the result of an old contusion, was found behind the rectum. Numerous large, pale and soft lymphatic glands were found in the mesentery and along the course of the abdominal aorta. Both axillæ contained masses of enlarged lymphatic glands; some of these glands were $\frac{3}{4}$ in. long and $\frac{1}{2}$ in. wide. Similar groups of enlarged glands were found in the groin.

Histology.

The organs were fixed in Zenker's fluid and embedded in paraffin.

Liver.—Under the low power of the microscope the sinusoids are seen to be dilated. The columns of liver cells are separated from one another and form a reticular pattern. The sinusoids are engorged with blood and contain an enormous number of leucocytes. The distribution of leucocytes is somewhat uneven. In the neighbourhood of the branches of the portal canal the leucocytes are particularly numerous. In some fields sinusoids are seen which may be described as packed with leucocytes. In other areas, and as a rule in the vicinity of the tributaries of the hepatic vein, the leucocytes are less obvious. In these regions the sinusoids are distended by red corpuscles. Even under the low power the liver cells have an empty and vacuolated appearance. Under a high power the changes in the nuclei and the cytoplasm are well seen. The changes in the liver cells are not of equal intensity in every part of the section. The majority of the cells appear somewhat larger than normal liver cells. The cell outline is, as a rule, distinct, but the cytoplasm has been replaced by a number of fine dots or granules. The majority of the cells show a nucleus which is centrally placed but does not stain deeply. The nucleus has an empty appearance. The rim is distinct, but the chromatin is represented by a faint reticulum and a few scattered granules. In some regions of the section, and usually near the central vein, the cellular changes are more pronounced. Here the cells are much larger than normal liver cells. The contrast between the sharply defined and clearly stained cell outline and the large empty cell body forms a striking picture. In some cells the nuclei have disappeared, in others the nucleus appears in faintly stained outline. The cell body has a foamy appearance and contains fine dust-like granules. An examination of the leucocytes in the sinusoids reveals the fact that there is a remarkable number of polymorphonuclear coarsely granular eosinophile cells. Some of the sections were sufficiently well stained to permit a rough differential count. A thousand consecutive leucocytes were examined with the following result :—

Polymorphonuclear eosinophiles 124
Other polymorphonuclear leucocytes 282
Mononuclear leucocytes 594

The granules of the eosinophiles are perfectly distinct and make possible a fairly accurate estimate of the percentage of this type of cell. Great difficulty was experienced in distinguishing the finely granular polymorphonuclear leucocytes from the lymphocytes and other mononuclear cells. The figure for the polymorphonuclear leucocytes is probably too low and for the mononuclear

cells too high. It is, however, evident that the blood of the sinusoids contains a remarkable number of eosinophile cells, and the relation between the presence of this type of cell and such conditions as asthma and urticaria, is too well known to need emphasis. It is unfortunate that nothing is known of this man's blood before the injection. The branches of the portal canal present an interesting picture. The connective tissue around the branches of the portal vein and bile duct is infiltrated by an enormous number of leucocytes. In some fields of the microscope the section of the portal canal appears as a circular nodule of leucocytes, among which the branches of the bile duct and the blood-vessels can be detected with difficulty. The intralobular veins are distended with blood. The blood in the intralobular veins and in the branches of the portal vein appears to contain an excess of leucocytes. The accumulation of leucocytes in the liver may be correlated in all probability with the leucopenia of the peripheral blood which is well known to accompany anaphylactic shock. It is remarkable that such extreme changes in the liver cells should have been produced in such a short time as one hour. As to the nature of the changes in the cells it is not proposed at present to offer any suggestion. Unfortunately, the only portion of the liver which was preserved for microscopical examination was embedded in paraffin. It is hoped that it may be possible to reproduce the condition in dogs, in which case a more extensive histological examination should be possible.

Stomach.—From the extreme engorgement of the liver it might be anticipated that the stomach would show marked changes. A section cut from the cardiac end shows dilated capillaries in the mucosa and submucosa. The vascular dilatation is by no means excessive. The blood in the vessels does not show a number of leucocytes. The glandular epithelium is normal. A section cut from the pyloric end shows an epithelium normal in structure. The cells are well fixed and well stained. It is seldom that post-mortem material affords such a satisfactory picture of the normal histology of the mucous membrane of the stomach. The small vessels and capillaries are somewhat dilated with blood. The contained blood shows no excess of leucocytes. Small accumulations of lymphoid tissue occur here and there in the mucous membrane.

Spleen.—The spleen pulp contains more red cells than are normally seen. Some of the small blood channels are dilated. The contents of some of the blood-vessels show an excess of leucocytes. There is no excess of polymorphonuclear cells in the spleen pulp. The section shows the normal relationship between Malpighian corpuscles and pulp. The degree of engorgement with blood is slight.

Pancreas.—The blood-vessels are filled with blood, and there appears to be a slight degree of dilatation of the capillaries. Some of the blood-vessels and capillaries, but not all, show a large number of leucocytes. With these exceptions the section of the pancreas shows no remarkable appearances.

Heart.—There are no obvious morbid changes in the muscle cells. Cross-striation is well preserved. The capillary vessels are slightly dilated. Some of the small vessels show an unusual number of leucocytes.

Lungs.—Two blocks were prepared from the right, and two from the left lung. The four sections do not differ materially from one another. In each section the appearances of different microscopical fields show considerable variation. In many places the alveoli are of normal size, while the capillaries show a moderate degree of dilatation. In other regions the capillaries are dilated and engorged, while the alveoli are more or less flattened and compressed. In hardly any case does this compression amount to complete collapse. Among the flattened alveoli occur here and there alveoli with a round outline, which appear to have been overdistended. In other parts occur groups of alveoli which are much dilated, and in some cases rupture of the walls is seen. Irregular dilatation of alveoli and rupture of walls is, however, no very uncommon finding

in sections made from post-mortem material. Throughout the lung the capillaries are dilated. This dilatation is but little marked in the walls of the more greatly distended alveoli. Where the alveoli are compressed the dilatation is considerable. In a few places minute hæmorrhages are seen, and here and there alveoli contain leucocytes and epithelial cells, or are filled with a pink-stained material which probably represents a microscopical degree of œdema. The epithelium of the bronchioles is normal in appearance. In a few places the bronchioles appear surrounded by a thin sheath of lymphoid tissue. Many of the capillaries contain a large number of leucocytes. The distribution of the leucocytes throughout the sections is very irregular. They are more numerous in the parts of the lung in which capillary dilatation is more marked, and in some microscopical fields the leucocytic infiltration presents a striking picture. Among the leucocytes many eosinophiles are seen. In other parts of the lung the capillaries contain but few leucocytes. The veins are well filled with blood, and the cross-section of some of the vessels shows a large number of leucocytes. Except for the number of leucocytes in some of the veins, and in some of the capillaries, the morbid changes in the lungs are in no sense remarkable.

Kidneys.—Blocks were prepared from each kidney. For some reason it has been found very difficult to stain the sections of these organs. There is a slight degree of dilatation of the capillaries which is best seen in the papillary zone, and the capillary loops of the glomeruli. The blood of neither arteries, nor veins, nor capillaries shows any considerable number of leucocytes. The tubular epithelium shows no morbid change.

Testis, Adrenal, Thyroid, and Prostate Glands.—Sections of these organs were examined. The microscopical appearances are normal. There is no accumulation of leucocytes in these organs.

Lymphatic Glands.—Sections of a gland from the neck and a gland from the inguinal region were examined. There is no great difference between the glands from these two regions. The glands are larger than normal. The gland of the neck has a thick capsule of old dense connective tissue. Thick fibrous tissue trabeculæ traverse and divide up the gland. In this fibrous tissue framework run thick-walled blood-vessels. The lymphocytes which make up the gland substance are normal in appearance and arrangement, except that the demarcation of the germinal centres is much less marked than usual. There is proliferation of the endothelial cells which line the lymphatic sinuses. There is some active fibrosis. The gland is more vascular than a normal lymphatic gland and capillary vessels containing red corpuscles are seen running in every direction. The large blood-vessels in the capsule, and in the immediate neighbourhood of the gland do not contain an unusual number of leucocytes. The blood capillaries of the gland do not show leucocytes. The gland of groin shows very similar changes, except that there is much less fibrous tissue and more marked dilatation of capillary blood-vessels than is seen in the section of the gland of neck.

Apart from the active congestion of the capillaries, the microscopical changes resemble those seen in lymphatic glands which have been the site of long standing infection. The changes in the lymphatic glands are those of chronic inflammation with hyperplasia of the lymphoid tissue.

DISCUSSION.

It seems probable that the cause of death was a fall of blood pressure produced by a dilatation of the sinusoids of the liver and perhaps of the capillaries of the lungs. The cessation of respiratory

movements may be explained by the fall of blood pressure and the deficiency of oxygen supply to the respiratory centres in the medulla. There is no evidence of any spasm of the bronchial muscles. The microscopical appearances of the lungs are sufficiently explained by the cessation of respiratory movements, cardiac failure and the attempts made to restore the patient by artificial respiration.

Information supplied by the father showed that the patient's health had been excellent up to the time when he joined the army. There is no record of any illness during his period of military service. The wounds had almost completely healed and during several days previous to his death the patient had been up and going out. He was regarded as convalescent and his general health was good. None of the organs of the body except the tonsils and the lymphatic glands showed any evidence of chronic disease. The tonsils were enlarged and enlarged lymphatic glands were found in the neck, the axillæ, the chest, the abdomen, and in the inguinal regions. No remnant of thymus tissue was found. In the stomach minute nodules of lymphoid tissue were found embedded in the mucous membrane. The microscopical changes found in the lymphatic glands are those which are commonly seen in glands which have been the seat of sub-acute or chronic inflammation. Of any generalised infection which might have involved all the lymphatic glands of the body there was no evidence in any organ, and there was no history of any such infection. That a general enlargement of lymphatic glands may be found in the bodies of persons who have met with sudden death is well known. That the enlargement of the lymphatic glands in this man may have been associated with a liability to sudden death must be admitted. Moreover, in view of the number of persons who received four or more injections of horse serum during the war and the extreme rarity of serious consequences, it must be supposed that this man's death was the result of some individual peculiarity. The enlargement of the lymphatic glands does, in fact, increase the difficulty of interpreting the microscopical changes in relation to the cause of death. Even if it is claimed that this man's death is an example of sudden death occurring in a case of status lymphaticus, the interest of an attempt to explain the way in which death was brought about remains at least as great. Whatever view may be taken of the significance of the changes in the lymphatic glands it seems probable that the effective cause of death was a sudden fall of blood pressure, in the production of which the active dilatation of the sinusoids of the liver played an important part. As will be seen in a subsequent section, the changes in this man's liver are very like those described by Weil (1917 [2]) in the livers of dogs, in which fatal anaphylactic shock has been produced.

The Accumulation of Leucocytes in the Liver.

Comparison with the Observations of Andrewes on Rabbits.

The association between anaphylaxis and leucopenia is well established and the mechanism of the leucopenia has been elucidated by Andrewes (1910 [1]) in his " Croonian Lectures."

In a preliminary investigation Andrewes determined the distribution of the leucocytes in the internal organs of two normal rabbits. The results were as follows :—

Tissue.	Polymorphonuclear Leucocytes per cubic millimetre of fresh tissue.	
	Rabbit 1.	Rabbit 2.
Spleen Pulp	68,000	38,400
Lung	20,000	12,000
Liver.	2,900	1,700
Kidney	250	...
Voluntary Muscle	...	20
Intestine	...	0
Medulla Oblongata	...	0

Andrewes examined the lungs and other organs of seven rabbits killed while in the leucopenic condition. Where the leucopenia was pronounced the number of polynuclears in the lung was very much increased. Thus in a rabbit immunised against streptococcus fæcalis and killed a quarter of an hour after a large dose of the living organism, Andrewes found 51,000 polynuclears per cubic millimetre of lung tissue. In a coli-immune animal dying two hours after a moderate dose of vaccine, with a circulating polynuclear count of 205 per cubic millimetre, there were 60,000 polynuclears per cubic millimetre of lung, but in an animal killed fifteen minutes after the injection of micrococcus citreus agilis, and which showed hardly any circulating leucopenia, the lung figures were normal, viz., 11,000 per cubic millimetre. No such increase was found in any organ except the lung. The figures for the spleen, liver, and kidney did not exceed those found in the normal animals (except in the case of the animal dying after the b. coli vaccine, in which the liver showed 13,000 polynuclears per cubic millimetre.

The results obtained by Andrewes throw considerable light on the microscopical appearances observed in the organs of this man. It appears probable that both in man and in the rabbit the leucopenia of anaphylaxis is associated with an accumulation of leucocytes in the internal organs. In the rabbit the chief site of this accumulation is in the capillaries of the lungs; the appearances noted in this one case indicate that in man the chief site may be in the liver.

Comparison between the Changes Observed in this Case and the Observations of Weil on Anaphylaxis in the Dog.

Weil (1917 [2]) succeeded in producing acute anaphylactic shock in dogs by the use of relatively large (20 c.c.) intravenous doses of serum. The symptoms produced in dogs are thus described by Weil:—

"The dog immediately vomits or retches and generally has a number of evacuations of the bowels. Within five minutes it begins to stagger and to drag

its hind legs. Following this preliminary stage comes a period of severe collapse, which, as a rule, appears within ten minutes of the injection. The animal lies on its side and does not respond to any stimulation. Respiration is either shallow and rapid or laboured and gives the impression of marked dyspnœa. During this stage, which terminates usually within thirty minutes, with the death of the animal, the other characteristic features of anaphylaxis make their appearance. The blood pressure sinks so low that the carotid pulse can scarcely be detected. If blood is aspirated from the veins it is found to have lost its coagulability to such an extent that it remains fluid for several days."

Post-mortem examinations carried out by Weil showed that in dogs which died of anaphylactic shock within an hour after the injection of the antigen, the liver is practically the only organ of the abdomen which is congested, while the stomach and intestines may be even less well supplied with blood than under normal conditions. The post-mortem appearances are thus described by Weil :—

" The liver is tremendously swollen. Its colour is intensely cyanotic. Upon section the cut surface bleeds freely. The pancreas, also, may show a slightly greater degree of congestion than normal. A very moderate degree of congestion is sometimes seen in the kidneys, the suprarenals and the spleen. Microscopical sections of the organs reveal marked changes in the liver. There is, in the first place, an intense congestion. The parenchyma cells show various changes which are not present in the same degree in all animals. There is cloudy swelling in varying degree. The cells may be greatly vacuolated, and their boundaries may be indistinct. One specimen showed a high degree of disseminated necrosis. The other organs present no definite microscopic alterations."

In a further series of experiments, Weil and Eggleston (1917 [3]) showed that the hepatic changes are due to the direct action of the injected antigen on the liver (probably the parenchyma of the liver) of the sensitised dog, and not to a general action on the vasomotor system. This sudden accumulation of blood in the sinusoids of the liver is the actual cause of the fall of blood pressure which in the dog is the direct cause of anaphylactic death. In the case of one dog which was killed in a state of shock, Weil calculated that the liver contained as much as 61·5 per cent. of the circulating blood. Another change associated with anaphylactic shock in the dog is loss of coagulability of the blood, and Weil by perfusing the liver of a dog in anaphylactic shock with blood from the carotid artery of a normal dog was able to prove the participation of the liver in this change.

It is obvious that the changes found in this case of anaphylaxis in man bear a striking resemblance to those observed by Weil in dogs. Weil does not mention any accumulation of leucocytes in the liver, but his account of the microscopical appearances is brief. It is intended by repeating Weil's experimental methods to obtain material from dogs for a more extended comparative study of the microscopical changes. Moreover, Weil inferred that the liver might play in man a similar part to that which it plays in anaphylaxis in the dog. He records that a fall of blood pressure and a slowing of the coagulation time may occur in cases of serum sickness. Of the accuracy of Weil's view the microscopical changes occurring in a man which are here described, offer striking confirmatory evidence.

The dramatic symptomatology of acute anaphylactic death in the guinea-pig and the ease with which it may be elicited, have resulted in the general use of this animal for experiments on anaphylaxis. Acute

anaphylactic shock is uncommon in man, and when it occurs the
necessities of the case leave little time or opportunity for accurate
observation.   In two cases, observed by the author, in which non-fatal
shock followed the intravenous injection of tetanus antitoxin, the
symptoms were compatible with a fall of blood pressure.   It is
obviously unjustifiable to draw general conclusions from one case, but
the evidence obtained from this case does confirm Weil's hypothesis
that the hepatic mechanism plays an important part in shock in man.
If this be true, our knowledge of the anaphylactic state in man may be
increased by further study of this condition in dogs.   In particular, it
might be well to test on dogs the efficiency of the therapeutic measures
which have been suggested for the treatment of anaphylaxis in man.
The close similarity between the changes found in this case and those
observed in dogs by Weil is related, probably, to the fact that both the
man and Weil's dogs died about an hour after the fatal injection.   The
importance of the time factor was emphasised by Weil, who pointed
out the difference between the changes in his animals and those
observed by Richet (1913 [5]) in dogs which died from two to six hours
after injection.   In many of Richet's dogs there was evidence of
intense gastro-intestinal congestion.   There was intense hæmorrhagic
diarrhœa and in some cases vomiting of blood.   After death Richet
found intense congestion with interstitial hæmorrhage in the whole
gastro-intestinal tract.   The lungs were congested and sometimes also
the endocardium and pleura.

    In Weil's dogs, which died as a result of a more acute form of
anaphylaxis, the intestinal congestion was slight or moderate in degree
or even absent.   This finding corresponded to the comparative lightness
of the gastro-intestinal symptoms.   The pulmonary changes described
by Richet were practically never in evidence.   On the other hand,
certain features of a case of fatal anaphylaxis in man described by
Gurd and Emrys-Roberts (1920 [4]) show a similarity to the happenings
observed in Richet's dogs.

    In the case described by Gurd and Roberts, the patient was a soldier,
30 years of age, who was admitted to a casualty clearing station with several
small wounds.   He was given a subcutaneous injection of 5 c.c. (750 units) of
tetanus anitoxin at 11.15 A.M.   It is believed that this was his first injection of
serum.   At 1.30 P.M. he commenced to vomit and had a bloody diarrhœa.   There
was a moderate degree of collapse.   Between 1.30 and 5 P.M. he vomited eight
times and had six bowel movements.   Blood clot was noted in the fæces.
At 11 P.M. the state of collapse became more severe, the heart rate rose to 160-
170 per minute, and the radial pulse could not be felt.   Extreme cyanosis was
observed.   The patient died at 10.30 A.M. on the following morning.   At the
post-mortem examination the veins of the splanchnic area were moderately
distended with fluid blood.   The liver was purplish in colour, but normal in
size and consistence.   The cut surface exuded an increased amount of fluid blood.
The stomach showed a moderate superficial capillary engorgement.   Both pleural
cavities were obliterated by adhesions.   The lungs were voluminous and downy,
except over the posterior parts, which were boggy and dark in colour.   Innumer-

able subpleural collections of deep purple-coloured blood were observed. The anterior portions of the lungs showed a dilatation of the alveoli and numerous small purplish red spots. Beneath the epicardium covering the auricles of the heart were numerous small purplish spots. Microscopical examination of the lungs showed that in some places the alveoli were compressed, in others they were greatly distended with apparent rupture of their walls. Some of the sections were composed chiefly of masses of blood-clot. The bronchioles were apparently contracted, and many contained large numbers of red blood cells. The microscopical examination of other organs yielded negative results except for a moderate to pronounced congestion of the small vessels, particularly in the liver, kidney, and lymph nodes.

The human case recorded by Gurd and Roberts resembles both in the symptoms and in the post-mortem findings the results obtained by Richet in his work on dogs, while the description given by Weil of acute anaphylaxis in dogs resembles in many respects the observations made of the case which is recorded in this paper. In this man, as in Weil's dogs, death occurred within about an hour of the injection of serum. In the case of Richet's dogs, death, when it occurred, was observed after an illness of two to six hours or more. In the case described by Gurd and Roberts death did not take place until nearly twenty-four hours after the injection.

SUMMARY.

1. The patient, a soldier aged 22, died of acute anaphylactic shock seventy minutes after a fourth injection of tetanus antitoxin.

2. As far as it can be ascertained the patient had been perfectly healthy until the day of his death. All wounds had completely healed at the time of death.

3. All four injections of horse serum were subcutaneous. The amount of serum injection on each occasion was presumably about 5 c.c. The intervals between the injections were 5, 16, and 12 days. No symptoms appear to have followed the earlier injections.

4. The onset of symptoms was immediate with cyanosis and vomiting. Death occurred in about seventy minutes and was apparently the result of a fall of blood pressure and cardiac failure.

5. At the post-mortem examination the liver weighed 62 oz., had a deep purplish colour and appeared to contain an excess of blood. Sections of the liver showed an extreme dilatation and engorgement of the sinusoids. The liver cells showed marked changes. In some regions the cytoplasm was granular and the nuclei stained badly. Other regions showed more advanced changes. The cells appeared to be swollen and empty. In many cells the nucleus had disappeared. The production of such marked changes within a period of seventy minutes from the time of injection is of interest. The lungs showed an irregular dilatation of the capillaries. In places the alveoli were compressed, in places dilated.

6. The tonsils were enlarged. There was an enlargement of the lymphatic glands of the neck, axillæ, thorax, abdomen, and of the inguinal regions. The glands were somewhat more vascular than normal and some showed an excess of fibrous tissue. There was no trace of thymus tissue.

7. The naked-eye and microscopical appearances of the liver were very similar to those described by Weil in acute anaphylactic death in dogs. It seems probable that in this man the primary and essential change was in the liver, and that a fall in blood pressure was the result of a dilatation of the capillaries of the liver.

8. The capillaries of the liver contained enormous numbers of leucocytes. There was an accumulation of leucocytes in the capillaries of the lungs and an unusual number of leucocytes was observed in some of the small vessels of the heart, stomach, pancreas, and spleen. In the case of the rabbit, the leucopenia of the anaphylactic state has been proved by Andrewes to be related with an accumulation of leucocytes in the capillaries of the lungs. In the case of this man, the leucocytes were massed in the capillaries of the liver. It will be of interest to ascertain whether a similar change occurs in the liver of the dog.

9. Twelve per cent. of the leucocytes in the capillaries of the liver were polymorphonuclear eosinophiles. The association between eosinophilia and such conditions as urticaria and asthma is well known.

10. The observations made in this case support Weil's belief that dilatation of the hepatic capillaries is an important factor in the anaphylactic state in man.

11. The general similarity between the changes observed in man and in the dog are an indication for the further study of anaphylaxis (and the treatment of anaphylaxis) in the dog.

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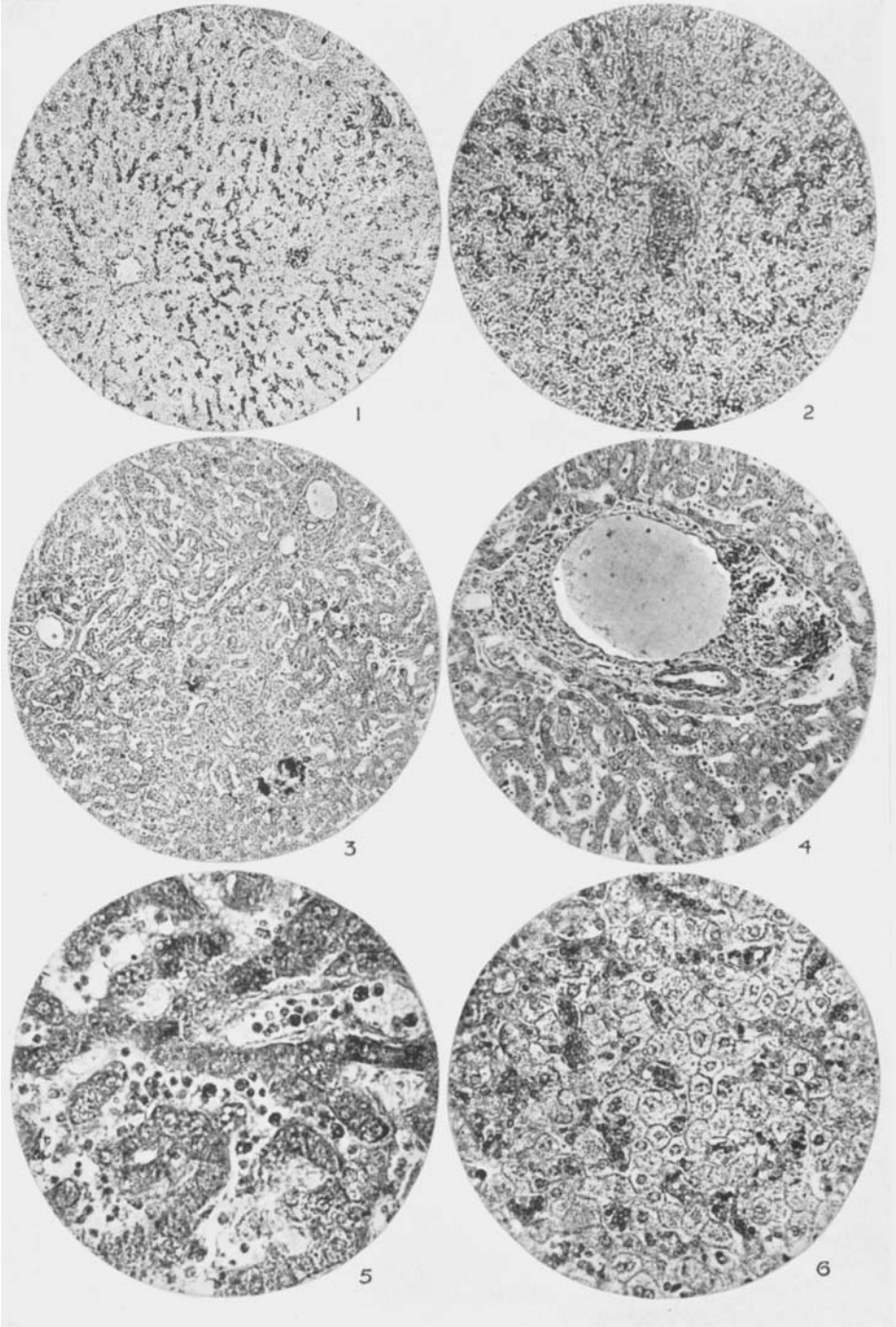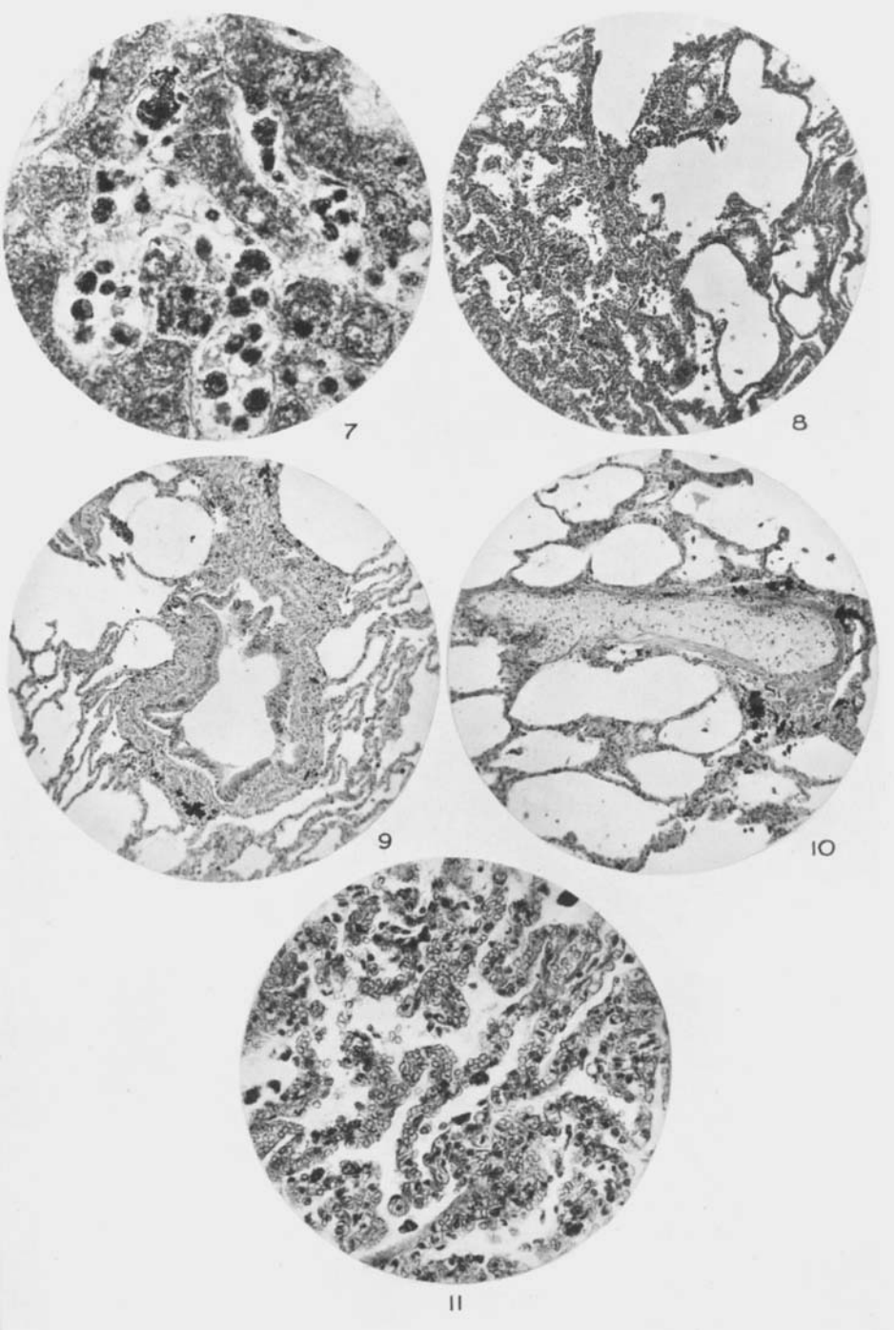
PLATE XVI.

DESCRIPTION OF PLATES

PLATE XVI.

FIG. 1.—LIVER—*Low Power.* The section was deeply stained with eosin to show engorged capillaries.

FIG. 2.—LIVER—*Dilated intralobular vein with engorgement of capillaries in central part of the lobule.*

In the upper part of the field clear empty-looking liver cells can just be seen.

FIG. 3.—LIVER—The field shows the condition in the peripheral part of the lobule. The columns of liver cells are separated by dilated capillaries. The nuclei of leucocytes appear within the capillaries as black dots.

FIG. 4.—LIVER—*The branch of the portal canal showing infiltration by leucocytes.*

The nuclei of the leucocytes in the adjacent capillaries are plainly visible.

FIG. 5.—LIVER—High power view of dilated sinusoids and contained leucocytes.

FIG. 6.—LIVER—*High power view of one of the more degenerated parts of the liver.*

The liver cells vary somewhat in size, and some appear to be dilated or distended. The cell outline is in many cases distinct. The cell body is clear and shows a fine granular appearance. In some cells the nucleus has disappeared, in others it is seen as a faintly stained ring in the centre of the cell.

PLATE XVII.

FIG. 7.—LIVER—Photograph taken with oil immersion lens of peripheral zone of lobule. Field selected to show eosinophile leucocytes.

FIG. 8.—LUNG—Low power view. Contrast between compressed and dilated alveoli.

FIG. 9.—LUNG—Alveoli showing various degrees of flattening and dilatation. Note normal appearance of bronchiole.

FIG. 10.—LUNG—Section of blood-vessels showing large number of leucocytes.

FIG. 11.—LUNG—High power view of flattened alveoli. Note engorgement of capillaries.