REVIEWS.


In this handsome volume Dr. Klein gives a full account of his researches into the minute anatomy of the lymphatics of the lung and pleura, a short summary of which had already been communicated by him to the Royal Society.¹

The work is divided into two sections, the normal conditions being described very fully in the first, while the second is occupied by a most interesting account of the pathological changes in acute and chronic inflammation, in the artificial tuberculosis of guinea-pigs, and in the acute miliary tuberculosis of man.

Commencing in the first section with the pleura, Dr. Klein points out a remarkable difference in the appearance of its endothelium in the distended and collapsed lung. In the former, in which it has to cover a wider area, the endothelium is seen as flattened plates, rather thicker in the centre, with a flattened circular nucleus, and only faintly granular body; whereas in the collapsed lung the cells are distinctly granular, and are moreover no longer flattened, but shortly columnar, with a spherical nucleus. The tops of the cells are seen to be rounded, leaving a considerable space between neighbouring cells, the deeper portions only of which are cemented together. The endothelium of the costal pleura consists of flattened plates, so that it differs from that of the pulmonary pleura in the same manner as Waldeyer has shown that of the surrounding part of the peritoneum to differ from that of the upper part of the ovary, the cells in each case bearing a close resemblance to an epithelium. Passing on to the matrix of the pleura, Dr. Klein describes it as consisting of extremely delicate connective tissue with a few elastic

fibres, small spaces occupied by connective tissue corpuscles, and communicating more or less completely with each other, being left between the bundles, and representing the lymph-canaliculæ system. In guinea-pigs a meshwork of unstriped muscle-fibre was also found, more especially developed in those parts which move most freely in respiration, and showing in the meshes lymphatic lacunæ, which communicate with the rich subpleural lymphatic plexus. The vessels forming this arise in the superficial alveoli, receive branches from the deeper parts of the lung, and discharge themselves into trunks that run in the ligamenta pulmonis to the bronchial glands. Dr. Klein has satisfied himself of the existence of stomata forming a communication between the cavity of the pleura and the above-mentioned superficial lymphatic plexus and intermuscular lymph-spaces; so that when these stomata are dilated (as happens in inspiration) the lymphatic system of the lung may become filled with whatever matter may occupy the pleural cavity. The stomata are best seen in the lungs of animals suffering from chronic pleurisy, when their position becomes very clearly indicated by a germination of the endothelium at their margins.

Dr. Klein next describes the lymphatic system of the bronchi. This consists of a rich network in the adventitia, constituting the peribronchial lymphatics, which receive branches from the submucous tissue, and anastomose with the perivasculæ lymphatics which accompany the blood-vessels. In the guinea-pig's lung (especially in animals suffering from artificial tuberculosis) there are spherical, oblong, or even cord-like accumulations of adenoid tissue in the wall of many peribronchial lymphatics. The larger ones are provided with a special network of capillary blood-vessels. These were suspected by Burdon Sanderson, who first described them, to be connected with the lymphatics, and are shown by Dr. Klein to be what he has called "peri-lymphangeal follicles," consisting of adenoid tissue in direct connection with the lymphatic wall. These follicles were also found in the rabbit's lung, but less numerous and not of so dense a structure. The rootlets of the peribronchial lymphatics consist chiefly of a system of communicating spaces in the mucosa, the muscularis, and the submucosa, which are interfascicular, and vary in size according to the amount of separation of the contiguous bundles. They are smallest in the mucosa, where they consist of lacunæ and anastomosing canals, whereas in the adventitia they are elongated or rhombic spaces; the former spaces are occupied by branched connective-tissue-corpuscles, while the latter are lined by
rows of flattened cells closely resembling an endothelium. Interspersed among the epithelium of the bronchi, branched connective-tissue cells were found, communicating by their processes with those of the mucosa, and thus forming a pseudo-stomatous tissue by means of which the lymph-canalicular system may be brought into communication with the surface of the bronchial mucous membrane. That such a communication does exist was proved by Sikorsky, who found that coloured particles introduced into the bronchi penetrated into the lymph-spaces of the mucosa.

Lastly, the perivascular lymphatics are described as originating in the walls of the alveoli by a lymph-canalicular system occupied by branched connective-tissue cells, whose processes often project between the epithelium lining the alveoli, and thus form pseudo-stomata, which permit of communication between the cavity of the alveoli and the lymph-canalicular system. The lymphatic trunks formed by the confluence of the capillaries which arise from the lymph-canaliculi accompany the branches of the pulmonary artery and vein, chiefly as distinct vessels running by their side, but often, especially around the smaller arterial branches, the lymphatic vessels are replaced by lymphatic lacunæ which communicate freely with each other. The arterial or venous branch was sometimes seen to pass directly through a lacuna, in which it thus becomes invaginated.

The pathological portion of the work begins with an account of the changes observed in the pleura pulmonum in inflammation. The endothelium was found to germinate around the stomata, more especially in chronic inflammation; and in the course of chronic pyæmia and artificial tuberculosis the changes found were, (a) thickening of the matrix of the pleura preceded by infiltration with lymphoid cells; (b) hypertrophy of the muscular coat in guinea-pigs, so that the meshes between the muscular bundles become much narrower, and even a continuous muscular membrane may be found in some parts; (c) the intermuscular lymphatic spaces and many subpleural lymphatic vessels become filled with lymphoid cells, derived, in all probability, partly from the germinating endothelium around the stomata, and partly from emigration from blood-vessels. These plugged lymphatics share in the formation of the characteristic nodules of artificial tuberculosis, so far as the superficial parts of the lung are concerned. The vessels at first only filled with lymphoid cells are converted into cords of adenoid tissue, by an outgrowth of their endothelial walls in the form of fine fibres, forming a reticulum between the cells. The cords leave
meshes corresponding to the superficial alveoli of the lung, which in early stages are filled with cells which are undoubtedly altered epithelium; and later, by cells indistinguishable from lymphoid cells. These nodules are to the naked eye at first rounded, grey, and transparent; later they increase in size, become of a more irregular shape, and their centre becomes opaque and caseous. This central softening extends gradually in all directions to the circumference, and the nodule which first forms a distinct prominence on the pleural surface, becomes depressed in the centre when softening is advanced.

In the substance of the lung Dr. Klein distinguishes granulations of three kinds. (1.) More or less well-defined nodules in connection with the walls of small bronchi. These he regards as simply hyperplasae of the normal adenoid tissue of this part. They are found at a comparatively late stage and do not soften. (2.) Perivascular cords. These are developed earlier around the small arteries, at first as endolymphangial follicles by plugging of lymphatics with lymphoid cells, and their subsequent conversion into cords of adenoid tissue, and then the cords become further thickened by a perilymphangial growth. Changes also take place in the blood vessels themselves. The endothelium of the ultimate branches of the pulmonary artery is found to germinate so as very materially to diminish the lumen of the vessel. In larger branches the middle coat becomes laminated, and infiltrated by lymphoid cells which extend into the coats of the vessel from the perivascular cords; finally the capillary vessels in the alveolar walls become ultimately converted into nucleated threads. This change takes place only in the later stages of the process, subsequent to a thickening of the alveolar septa by encroachment of the perivascular cords. In the perivascular cords no caseous degeneration (softening) was ever found. (3.) The last kind of granulations is due to catarrhal pneumonia. The alveolar septa become thickened as above described, and the alveoli themselves become blocked at first by alveolar epithelial cells and their derivatives, giant-cells forming a prominent feature. The largest of these Dr. Klein believes to originate from a fusion of several epithelial cells, as their substance shows an indication of being divided into territories. The catarrhal changes finally spread from the alveoli to the infundibula and small bronchi. It is these catarrhal pneumonic granulations which undergo caseation, a process which spreads at last to the thickened alveolar septa.

The last chapter is devoted by Dr. Klein to an account of
acute miliary tuberculosis in man, based upon the examination of the lungs of seven children who died of this disease. He found that in early cases the tubercles were due to cattarrhal pneumonia; the alveoli being found distended with a fibrinous material in which numerous lymphoid cells (emigrated colourless corpuscles) were imbedded, the structure of the alveolar wall was barely discernible, and its capillaries obliterated. In later stages the fibrinous exudation which occupied the alveoli gradually disappears by absorption and becomes replaced by groups of cells which are mostly derived from the alveolar epithelium, or by one large multinuclear mass or giant-cell. The giant-cell is connected by processes with a retiform tissue infiltrated with lymphoid cells, which represents the alveolar septa. This is not true adenoid tissue, but is regarded by Dr. Klein, in agreement with Schüppel, as formed by cells derived from the giant-cells. The giant-cell finally degenerates into a mass of débris, sometimes passing through a previous fibrous stage. Dr. Klein considers that, in the lung, giant-cells are formed from the alveolar epithelium, though he admits that it is possible that they may arise (according to the observations of Ziegler) from emigrated colourless blood-corpuscles. In still later stages, when the above tubercles already show necrotic changes, numerous blood-vessels are found surrounded by perivascular cords, and spherical collections of adenoid tissue are met with in the adventitia of the bronchi, so that the various processes take place in man in inverted order as compared with the artificial tubercle of guinea-pigs.

The book is illustrated with six admirable double plates, and is certainly among the most valuable of Dr. Klein's numerous contributions to normal and pathological histology.


No working histologist who is acquainted with the German language needs any introduction to Professor Frey's manual. Avowedly a compilation, it is yet a very satisfactory and valuable compilation, and, especially for students' use, is perhaps the most useful text-book on the subject in any language. It is hardly necessary to say that it has gone through several editions, and as each successive issue has had to be brought up to the present day, as the phrase is, some parts present a curious patchwork of conflicting views, or