were more readily killed than heavier ones. In other words, this germicidal phenomena is quantitative. It was also noted that the further the source of the rays was from the organisms, all other things being equal, the less the bactericidal action. The longer the time of action, the greater the danger to both the bacteria and spirochætes. A period of exposure of 90 to 120 seconds at close range consistently proved detrimental or lethal to the pallida. Up to an interval of one minute, they were little affected.

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Experimental studies on the formation of Hassall's corpuscles.

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This work was undertaken with the hope that a study, by the method of autoplastic transplantation, of the regenerative changes in the thymus gland of an animal like the guinea pig, whose thymus normally contains large numbers of Hassall's corpuscles, would yield some conclusive information concerning the origin of these structures.

Since 1846 when Hassall[1] described these corpuscles, they have held the attention of histologists, embryologists, and pathologists who have worked with this gland. It is interesting, that even today, in spite of the great number of studies dealing with the thymus gland, there is no unanimity of opinion in regard to the origin and possible function of these corpuscles.

A review of the meager thymus transplant literature shows that the previous work cannot be evaluated for our own histological studies, since none of the previous workers studied in detail the cytological changes which occur in the regenerating transplant.

In this work we used young guinea pigs, varying in age from 30 to 45 days. Both main lobes of the thymus were removed and they were immediately placed in a sterile physiological salt solu-

[1] Hassall, The microscopical anatomy of the human body in health and disease. London, 1846.

tion which was kept between 37 and 39° C. The abdominal wall was then prepared for the transplantation, and one whole thymus lobe was inserted into a pocket under the fascia. Great care was exercised to avoid bleeding into the pocket. The site of the transplant was indicated by closing the fascia with a silk ligature.

The progressive changes in the transplant were studied from 1 to 48 days after insertion, using Helly's fixation and paraffin embedding. The tissues were cut serially and stained with hematoxylin-eosin, Mallory's phosphotungstic hematoxylin, and Van Gieson.

Our work shows that the thymus gland of the guinea pig, when transplanted autoplastically undergoes a series of changes similar on the whole to those previously described in the rat.[2] These changes are characterized by degenerative phenomena which begin within a few hours after transplantation and reach their height in about two days. In the guinea pig, however, unlike the rat, excellent opportunities are afforded for the study of the degenerative and regenerative changes in the Hassall's corpuscles.

During the first 24 hours the number of corpuscles in the transplant is greatly diminished, and those remaining are markedly degenerated. They appear as small, irregularly concentric, fibrilla, practically acellular structures. At the end of the first 24 hours the transplant becomes vascularized and absorption of the debris begins. Regenerative changes set in between the 48th and 72nd hours, at the periphery of the lobules, and these are characterized by proliferation of the reticular cells which are at first spindle shaped, but as regeneration progresses these reticular cells become epitheliod, and finally polygonal in shape. Definite regeneration, with the appearance of well-formed Hassall's corpuscles, occurs about the 5th day; and the developments of these may be traced to the hypertrophy of single cells or cell groups of the reticular epithelium, which as they enlarge, push the neighboring cells aside and compress them. At the same time, the neighboring regenerated reticular epithelial cells may become hypertrophied leading to an increase in size of the Hassall's body, while the central cells undergo degeneration. Frequently one sees fusion of several corpuscles to form a large compound Hassall's body. While our sections show that Hassall's corpuscles are formed by hypertrophy of the reticular cells, there seems to be no doubt that these cor-

[2] Gottesman and Jaffe, *J. of Exp. Med.*, (in press).

puscles may also be formed, in a transplant, as a result of the development of single or multiple areas of degeneration in the centers of solid masses of reticular epithelium.

About the 8th day, the regenerating lobules, particularly at the periphery of the transplant appear like surface epithelium; the proliferated reticular cells being polygonal in shape with definite cell walls, and cement substance between the individual cells. These regenerated lobules also contain Hassall's corpuscles with areas of central degeneration, and the sections give the illusion of a malignant epithelioma.

As regeneration progresses the lobules take a lymphoid character, about the 10th day, by the appearance of small round thymic cells between the reticular epithelial cells. Concommitantly with this there is a reduction of the number and size of the Hassall's corpuscles.

By the end of the second week the lobules become differentiated into cortex and medulla. In the regenerated differentiated lobules, the Hassall's corpuscles appear either as nests of well-preserved epithelial cells with slight or no evidences of central hyalinization, or, as typical Hassall's bodies made up of concentrically placed cells, in the center of which is a mass of nuclear debris with some dense hyaline cytoplasmic or plasmic remains. The outermost cells are usually best preserved, while the remaining layers show progessively increasing keratinization.

Regenerated ducts with ciliated epithelium are occasionally seen in the thymus transplant of both the rat and the guinea pig. The ducts have developed undoubtedly from the pre-existing ducts which were present in these glands before transplantation. The development of Hassall's corpuscles from reticular epithelium is quite independent of the formation of the presence of these ducts in the transplant.

Conclusions: 1. These studies seem to bring unequivocal experimental proof that Hassall's corpuscles are derivatives of the reticular epithelium; a view originally proposed by Paulitsky and more recently elaborated by Hammar, and supported by many others on the basis of embryological and post fetal histological studies.

2. They also show that in post fetal life the formation of Hassall's corpuscles is independent of the presence of remnants of the original epithelial ducts of Remak.