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Attempts to Establish the Armadillo (*Dasypus novemcinctus* Linn.) As a Model for the Study of Leprosy

II. Histopathologic and Bacteriologic Post-Mortem Findings in Lepromatoid Leprosy in the Armadillo[1]

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The literature dealing with previous attempts to transmit leprosy to animals and the need for a more valid animal model of the disease has been reviewed and discussed by Kirchheimer and Storrs (5). It was stressed that universal species susceptibility to leprosy should not be expected to exist in animals, since universal susceptibility obviously does not exist in man, the natural host for *Mycobacterium leprae* (1-7). The unique potential of the armadillo for the study of leprosy has been discussed by Kirchheimer and Storrs (5, 8). In these same publications, it was reported that one of the armadillos (armadillo No. 8), which had been inoculated with viable leprosy bacilli from an untreated case of lepromatous leprosy, had developed a spreading form of the disease. This particular armadillo had been inoculated on 10 February 1970, with $8.9 \pm 0.4 \times 10^6$ leprosy bacilli into each earlobe and into two cutaneous skin sites of the abdomen. It succumbed to its disease 520 days later. In the present communication, histopathologic autopsy findings on this animal are reported and data on the numbers and viability of leprosy bacilli in various organs removed at necropsy are presented.

MATERIALS AND METHODS

On the death of the armadillo, on 15 July 1971, at the Gulf South Research Institute in New Iberia, Louisiana, 7 ml of heparinized blood was obtained by cardiac puncture. Thoracic and abdominal viscera were removed and were kept on wet ice together with the remaining carcass. The following day, all materials were transported on wet ice to the Carville USPHS Hospital laboratories. There, the plasma was removed from the sedimented blood. Buffy coat cells were aspirated by means of a capillary pipette, spread on glass slides, air-dried, and fixed in formaldehyde vapor. The films were then stained with gently heated carbol fuchsin for three to five minutes, decol-

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orized with acid alcohol, and counterstained with methylene blue.

At this time, the brain together with the medulla oblongata and the spinal cord, left femoral, left ulnar, left peroneal, and left posterior tibial nerves were removed. Also removed were: the spinal nerve root of the first lumbar vertebra; both earlobes; a piece of normal appearing skin; an enlarged lymph node from the right inguinal region; and slightly ulcerated, nodular, cutaneous lesions from the area below the first band of the carapace on the right side and from both hind foot pads. Additionally, one eye was excised—the other one was absent, probably through previous injury. The blood plasma and the carcass of the animal were preserved in a deep freezer at a temperature of —65°C.

All autopsy specimens were fixed in 10% neutral formalin, embedded in paraffin, and sectioned. The sections were routinely stained with hematoxylin-eosin and the Fite-Faraco modification of the acid-fast stain. Kidney sections also were stained for the presence of amyloid by the crystal-violet procedure. In some instances, duplicates of the stained sections, or portions of the organs preserved in formalin, or of the paraffin blocks, were sent to the Armed Forces Institute of Pathology, Washington, D.C.

Bacterial suspensions were prepared from weighed amounts of some of the fresh tissue for the purpose of bacterial enumeration and viability determination. Lowenstein-Jensen slants were streaked with all bacterial suspensions prepared from the tissues and incubated at 37°C and 33°C respectively. Methods of preparation of bacterial suspensions, bacterial enumeration, and determination of bacterial viability have been described in a previous communication ([5]).

RESULTS

Histopathologic report. *Inoculated skin of the abdomen.* This section, approximately 10 x 7 mm in size, had been taken through a gross nodule of the skin. Nonulcerated epidermis is attached to a part of the specimen; the remainder demonstrates ulceration and necrosis. Histiocytes containing acid-fast bacilli are associated with the vascular papillae that protrude into the epidermis, but bacilli are not seen within epidermal cells. This feature, therefore, differs from human lepromatous leprosy in which, characteristically, there is a "free zone" separating the basal layer of the epidermis from the infiltrate of the dermis.

In the stroma of the superficial dermis there are many solitary macrophages containing numerous bacilli. In small infiltrates, where the growth of bacilli is not overwhelming, the cells that contain bacilli are fairly large, round, or oval macrophages, approxiamtely 15 microns in diameter, with single, variously shaped nuclei, deeply stained with hematoxylin that are usually located in the periphery of the cells. Examination under the oil immersion lens, discloses a very fine reticular meshwork within the cytoplasm of these cells.

In the deeper part of the section where the process is much more severe, the integrity of many macrophages has been partly

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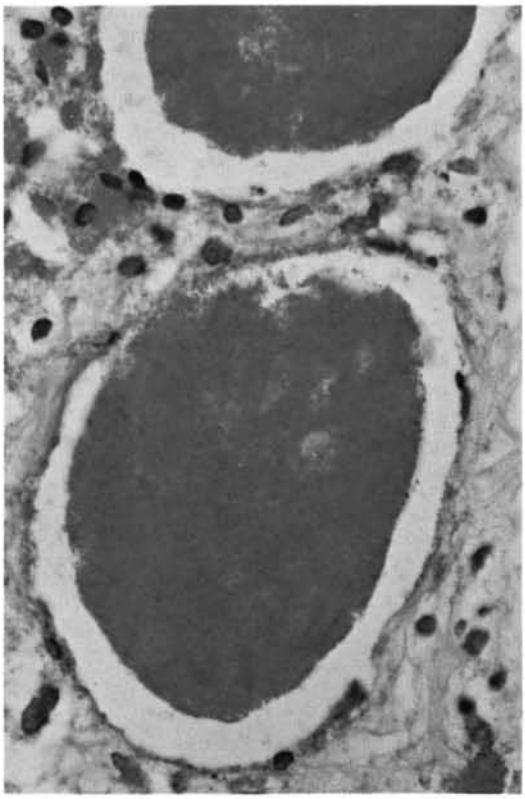
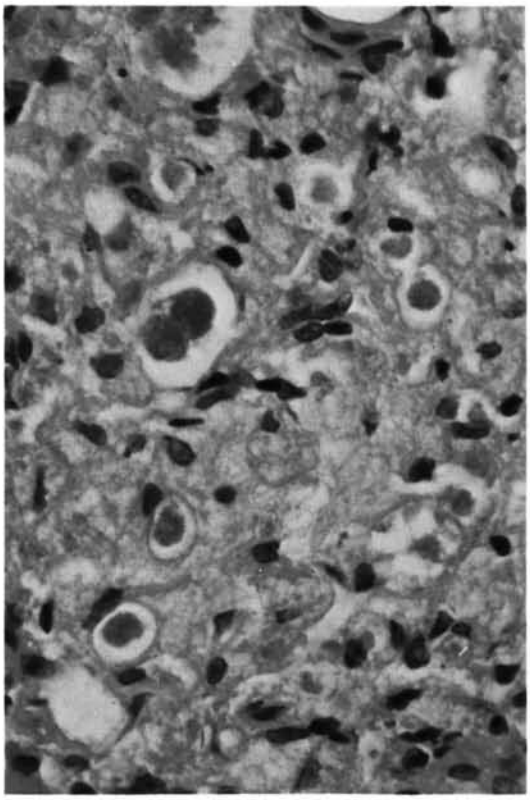
FIG. 1A. Upper left. Skin, abdomen. Observe the giant globi, a feature occasionally seen in advanced, untreated human lepromatous leprosy. With the hematoxylin stain these giant globi were seen as solid, dark-purplish masses. Fite-Faraco stain, X 615, AFIP Photo No. 72-3690.

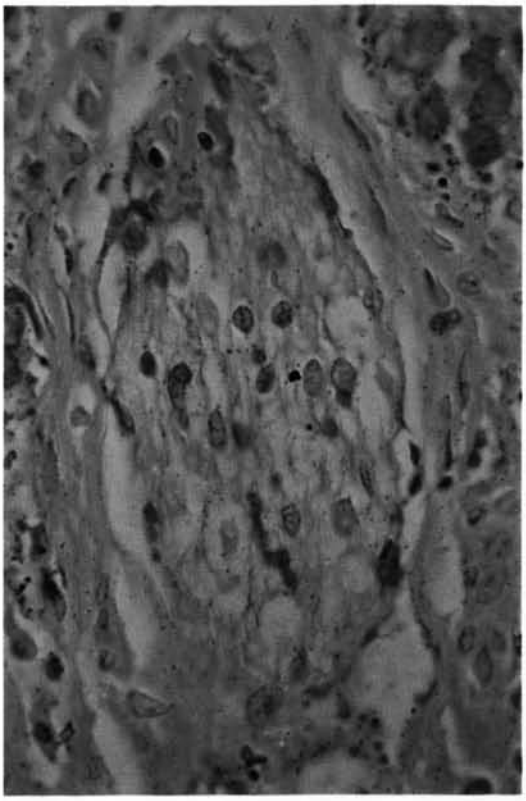
FIG. 1B. Upper right. Skin, abdomen. Observe in this hematoxylin and eosin stained slide that the globi and foamy histiocytes are typical for human lepromatous leprosy. X 615, AFIP Photo No. 72-3695.

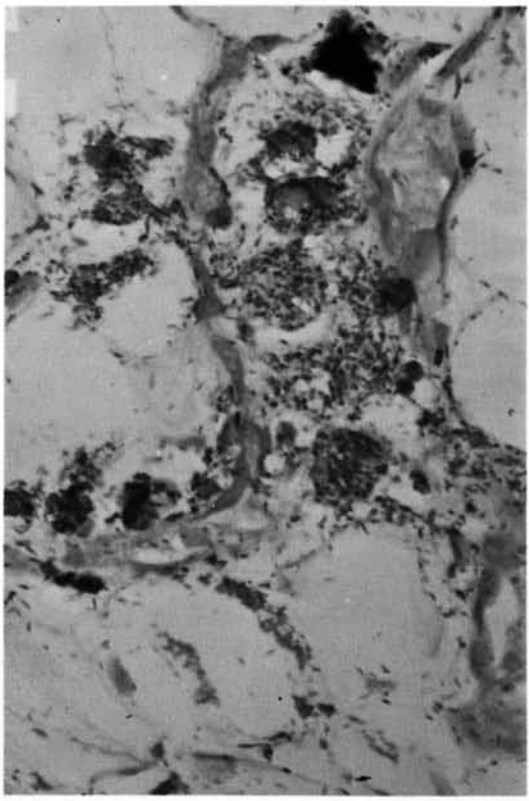
FIG. 1C. Lower left. Skin, nerve. Observe the intraneural bacilli in a nerve that is not yet destroyed—a feature characteristic for active, progressive human lepromatous leprosy. Fite-Faraco stain, X 485, AFIP Photo No. 72-3692.

FIG. 1D. Lower right. Meninges. Observe the severe involvement by acid-fast bacilli. Fite-Faraco stain, X 615, AFIP Photo No. 72-3698.









lost and their reticular structure is not well-defined. In these cells the cytoplasm contains small amorphous particles, deeply stained by hematoxylin. In many areas of the section where the stroma is disintegrating, large, rounded, or oval masses of hematoxylin-positive amorphous material are very conspicuous. Some of these masses are 80-100 microns in diameter. They appear as conglomerates of material staining deeply with hematoxylin. The Fite-Faraco stain demonstrates that these hematoxylin-positive bodies are masses of acid-fast bacilli (Fig. 1A). These large masses lie in spaces in the stroma and, although occasionally there may be a few cells partly lining these spaces, there is no clearly displayed foreign body reaction such as is usually seen around the giant globi of human lepromatous leprosy. There are within the cytoplasm of degenerated macrophages ("lepra" cells) hematoxylin stained bodies (Fig. 1B) that are typical for globi as seen in hematoxylin and eosin stains of human lepromatous leprosy. In some microscopic fields, the bacilli are so numerous that, except for a few strands of persisting stroma, many oil immersion fields are entirely red. In the part of the section that includes the ulcer, the lepromatoid infiltrate is necrotic, and cocci and bacilli mingle with acid-fast bacilli.

Non-inoculated skin of abdomen. Smooth, intact epithelium demonstrates no rete pegs and no papillae. No bacilli are seen in the epithelial cells, but single histiocytes containing bacilli are found subjacent to the basal layers of the epidermis. In the superficial zone of the dermis, the lepromatoid infiltrate consists of relatively small clusters of typical histiocytes. More deeply, entire microscopic fields are involved by large histiocytes resembling those described in the section of skin from a site originally inoculated. More severe involvement appears in the lower part of the dermis where the entire tissue consists of a dense infiltration of histiocytes with gradation into cystic spaces similar to those described in the previously characterized section. In some fields there are large masses of acid-fast bacilli in cystic spaces, similar to those shown in Figure 1A. The stroma in this section has not undergone the severe degeneration that was observed in the first described section. In the thick, muscular wall of a blood vessel there are several groups of acid-fast bacilli. In deeper parts of the dermis where it meets the subcutaneous tissue, the entire tissue exhibits dense infiltration by histiocytes and degeneration of the stroma that shades into large cystic spaces, some of which contain bacilli. Several nerves present do not show any appreciable intraneural cellular change, but they all show invasion by acid-fast bacilli (Fig. 1C). In some of the nerves there are only a few perineural cells infected but small clusters of bacilli are seen intraneurally.

Skin of earlobes. The tissue is densely infiltrated with foamy histiocytes ("lepra" cells) which contain enormous numbers of acid-fast bacilli, mainly in clumps; cutaneous nerves contain many acid-fast bacilli, singly and in packets within histiocytes.

Skin lesion, first band of carapace. With the exception of a denuded area, the epithelium appears normal. As in other sections of skin, there are large accumulations of lepra cells filled with bacilli, and large cystic spaces, partially or entirely occupied by acid-fast bacilli.

Liver. In the hematoxylin and eosin stained sections, there are conspicuous, more or less circular areas, sometimes filling the entire field of the oil immersion (1 mm) lens, composed of large macrophages with turgid, slightly vacuolated cytoplasmic zones that contain one or more rounded masses of dense hematoxylin stained material (Fig. 2A). In the Fite-Faraco stain these cells are shown to be filled, or partly filled, with acid-fast bacilli (Fig. 2B), and the rounded intracytoplasmic masses, observed in the hematoxylin stain, are shown to be composed of densely packed bacilli. Throughout the section sinusoids contain many lymphocytes or plasma cells, and isolated histiocytes containing acid-fast bacilli are found.

Spleen. Only rarely are there remnants of follicular architecture. Within the pulp there are many neutrophils and numerous histiocytes distended with hematoxylin stained material, frequently in the form of large globular masses. By the Fite-Faraco stain, the material in the large histiocytes is

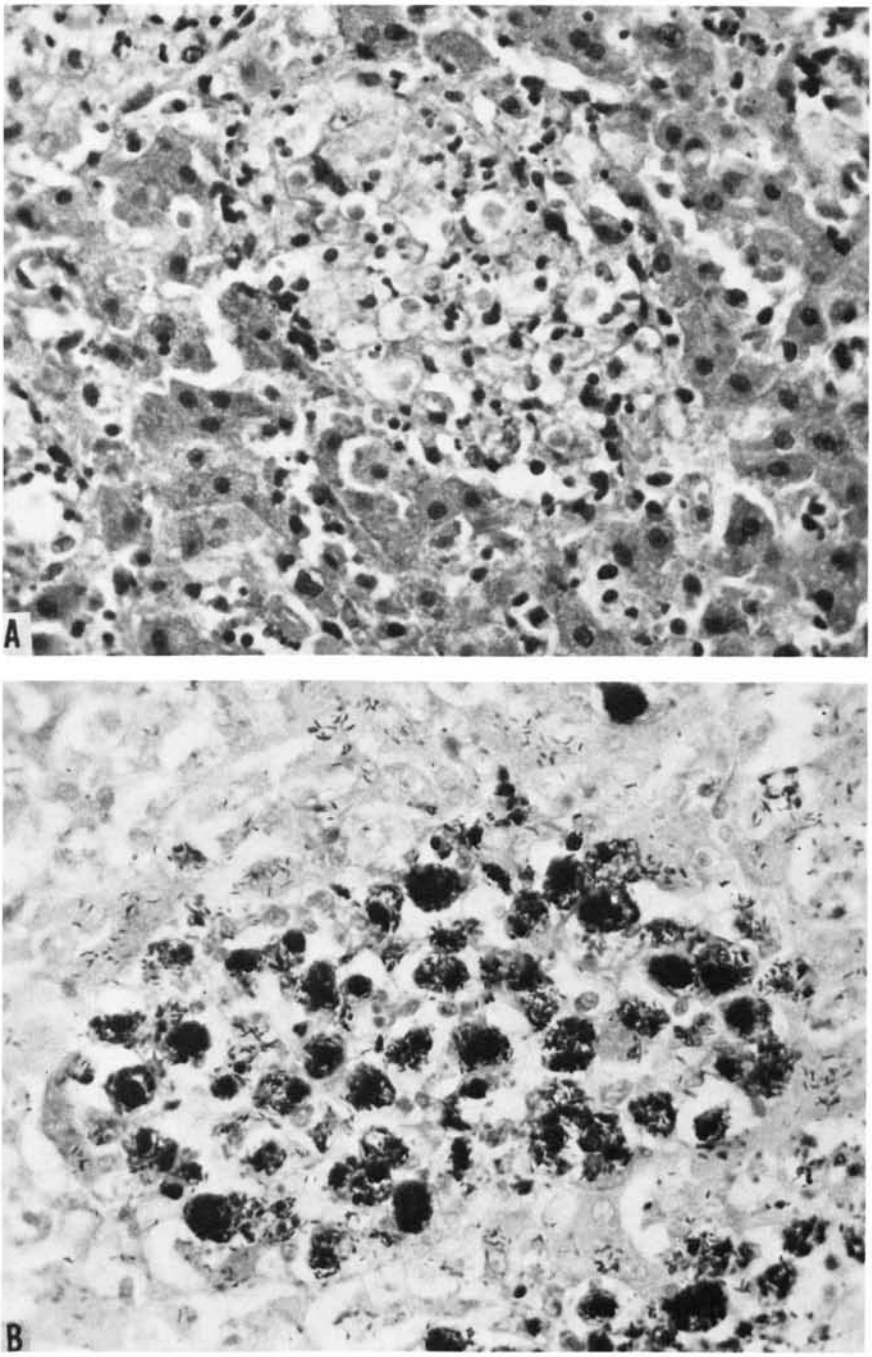


FIG. 2A. Liver. Lepromatoid lesion in liver. Observe the foamy histiocytes and hematoxylin stained intracellular globular masses. H & E stain, X 395, AFIP Photo No. 72-3696.

FIG. 2B. Liver. Field similar to that shown in A. The use of green filter has caused the bacilli to photograph jet-black. Fite-Faraco stain, X 450, AFIP Photo No. 71-10692.

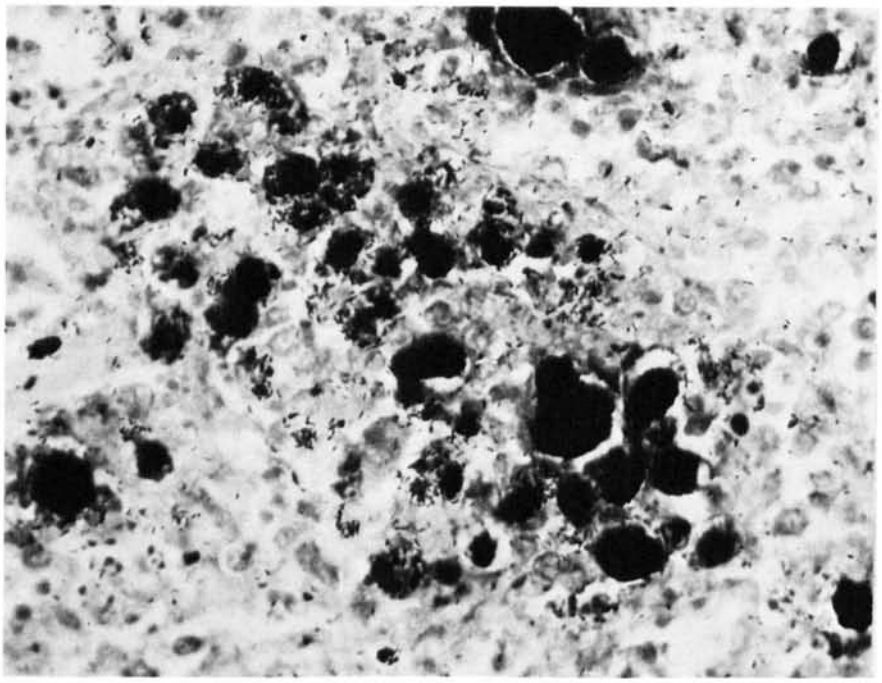


FIG. 3. Spleen. Observe in the masses of acid-fast bacilli that appear black in the photomicrograph. Fite-Faraco stain, X 525, AFIP Photo No. 71-10693.

shown to be composed of acid-fast bacilli (Fig. 3). There are numerous giant-sized globi. In less severely involved areas, many phagocytes in the pulp contain acid-fast bacilli. Linear masses of well-preserved bacilli are seen within the elongated cells of the splenic stroma and in the capsule.

Adrenal gland. In the cortex there are some histiocytes that contain clusters of acid-fast bacilli.

Testes. In the tunica there are several clusters of cells that contain bacilli, but within the testes, the tubules and interstitial tissues appear to be free of bacilli. There is active spermatogenesis; the spermatic cord has no lesion and no bacilli.

Peripheral nerves. Cross sections of the left peroneal nerve reveal small numbers of intraneural phagocytes containing well-preserved acid-fast bacilli. The loose perineural tissue shows many histiocytes filled with bacilli.

The perineural and perivascular tissue around the left femoral nerve contain many histiocytes with bacilli, but intraneural bacilli are not seen. Many bacilli are seen in histiocytes in a small perineural lymph node and a vein contains bacilli within its wall and endothelium. The perineural tissue of the left posterior tibial nerve is similar to that of the left femoral. No bacilli are seen within the nerve. The left ulnar nerve appears normal.

Spinal nerves. An occasional spinal nerve near the spinal cord contains intraneural bacilli and some bacilli are seen within the nerves of the *cauda equina.*

Lung. The histopathologic features seen in the lung vary from an area in which there is a solid histiocytic infiltrate (Fig. 4A) that obliterates all alveoli to areas where there is thickening of septa by histiocytic proliferation and partial filling of alveoli by histiocytes. In all areas, there is an impressive number of histiocytes containing many bacilli and conspicuous, large, circumscribed, globular masses of acid-fast bacilli (Fig. 4B).

Kidney. Many glomeruli show small numbers of intracellular bacilli. Occasionally, small, rounded masses of bacilli are found in glomerular tufts (Fig. 5). There is

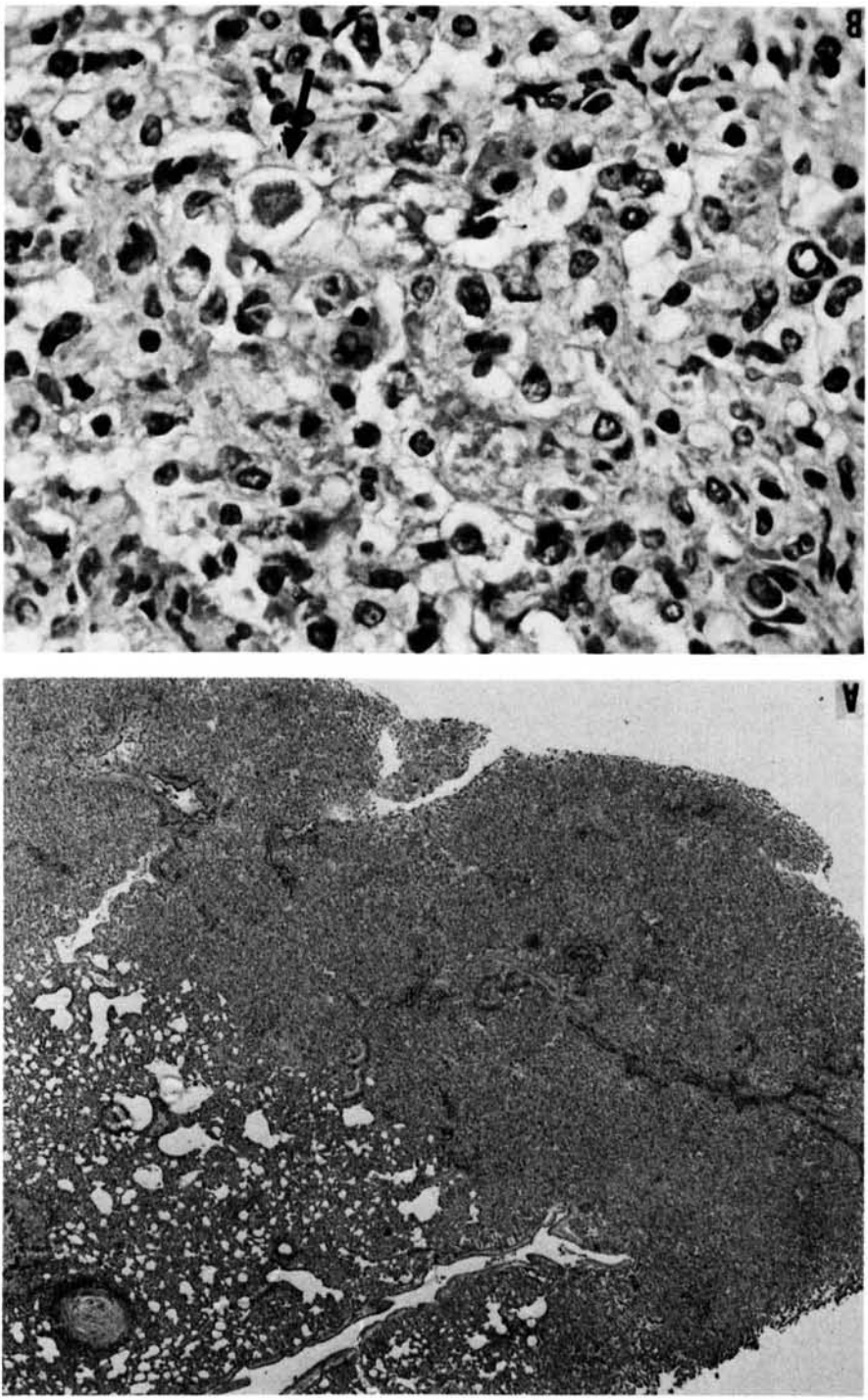


FIG. 4A. Lung. Low power showing consolidation. H & E stain, X 20, AFIP Photo No. 71-10696.

FIG. 4B. Leprotic pneumonitis shown by the diffuse replacement of parenchyma by foamy macrophages. Arrow points to a small globus. H & E stain, X 615, AFIP Photo No. 72-3697.

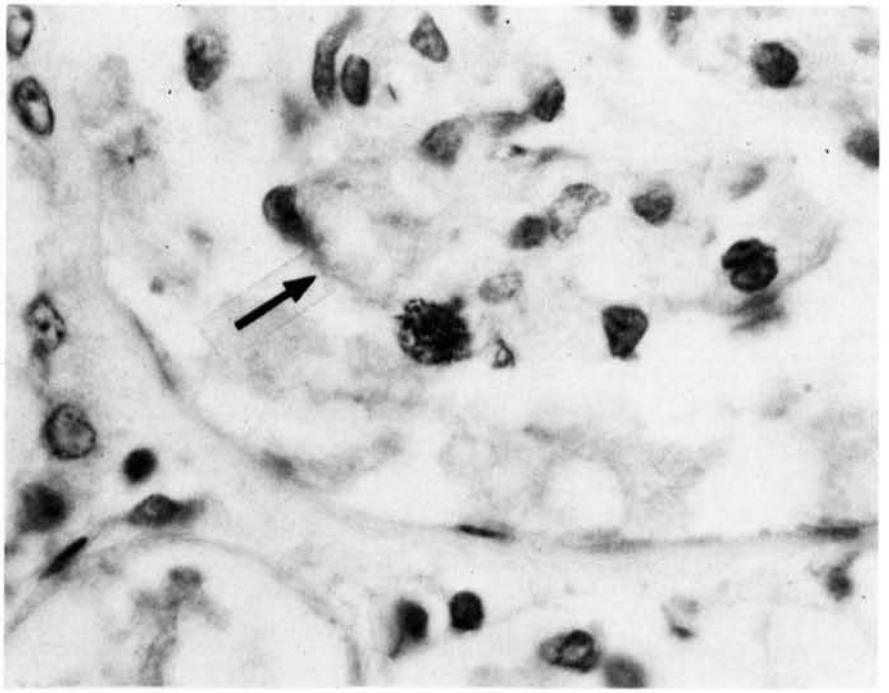


FIG. 5. Kidney. The arrow points to a renal glomerular tuft within which is a macrophage filled with acid-fast bacilli. Fite-Faraco stain, X 970, AFIP Photo No. 72-3700.

no evidence of amyloid in a section stained by a crystal violet method.

Tongue. In a section of the peripheral part of the tongue, the epidermis is intact; in the papillary and sub-papillary stroma there are areas of infiltrate composed of histiocytes containing many bacilli. Nerves are moderately involved in some fields. Within the muscular stroma are some fields with many bacilli in macrophages, but striated muscle fibers do not contain bacilli. In a section taken more proximally, there is one field of lepromatoid infiltrate just beneath the epithelium.

Esophagus. In the papillary stroma of the esophagus, there are many histiocytes containing bacilli and occasionally the bacilli seem to be within the epithelial cells. In the underlying stroma, there are many microscopic fields in which the histiocytes contain a fairly large number of bacilli. The wall of the esophagus shows several phagocytes containing bacilli.

Stomach and small intestine. An occasional large histiocyte in the mucosa contains bacilli.

Large intestine. No bacilli or lesions are seen.

Pancreas. An occasional clump of acid-fast bacilli is seen in histiocytes of the stroma between the acinar cells.

Aorta. No lesions and no bacilli are observed.

Heart. Occasionally, between muscle fibers, there are small numbers of histiocytes containing acid-fast bacilli. No bacilli are seen within muscle fibers.

Diaphragm. No lesions are observed, but occasional histiocytes containing bacilli are seen between the muscle fibers. No bacilli are seen within the striated muscle ([6]).

Lymph node, right inguinal. The normal architecture has been almost completely replaced by a lepromatoid infiltrate containing globular masses of acid-fast bacilli.

Bone marrow. After the carcass of this animal had been frozen for some time, sections of bones were sent to the Armed Forces Institute of Pathology for histologic examination. In the process of freezing and thawing, the histologic features were greatly distorted.

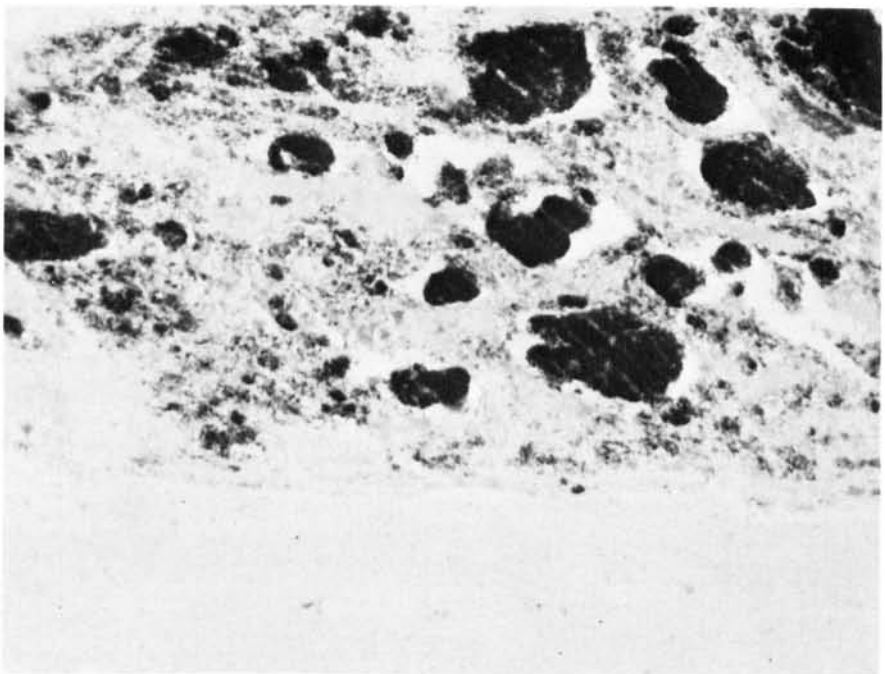


FIG. 6. Bone marrow, rib. Observe the masses of acid-fast bacilli (appearing black in photomicrograph) that virtually replace marrow cells. Fite-Faraco stain, X 300, AFIP Photo No. 71-10763.

Decalcified sections (Fig. 6), of femur, tibia, and fibula show numerous marrow cells containing acid-fast bacilli. In some fields, more than 50% of the cells contain bacilli. Striated muscle attached to bone shows no involvement.

Right and left hind foot pads. There is macrophagic invasion of the tissue. Many acid-fast bacilli, often in clusters, can be seen within these cells.

Foot. Sections taken from two feet were decalcified for histopathologic studies. The bone marrow is almost completely replaced by cells containing acid-fast bacilli. The soft tissue adjacent to the bone is also severely involved. A few attached muscle fibers contain bacilli, but larger areas of muscle show no involvement.

Eye. It was noted in the report of the gross autopsy observations that one eye had been lost by injury. The remaining eye, fixed in neutral formalin, was submitted intact to Lorenz E. Zimmerman, M.D., Chief of the Ophthalmic Pathology Branch, Armed Forces Institute of Pathology, Washington, D.C. He reported as follows:

> Evaluation of sections prepared from the armadillo eye (AFIP Acc. 1386667) is not entirely satisfactory because there is advanced post-mortem autolysis and because we are not entirely familiar with the eye of the armadillo. It is, nevertheless, apparent that there is a light but diffuse infiltration by chronic inflammatory cells throughout the uveal tract, most marked anteriorly in the vicinity of the iris root and *pars plicata* of the ciliary body. Fite-Faraco preparations reveal many small clusters of acid-fast bacilli within the areas exhibiting an infiltrate by chronic inflammatory cells. The organisms are morphologically quite consistent with *Mycobacterium leprae.*

Central nervous system. Examination of many sections of brain, including cerebellum and sections from four levels of the spinal cord, reveals no lesions or bacilli. No lesions are observed in the choroid plexus.

Meninges. One section of meninges

(Fig. 1D) consists of several pieces of bone adherent to a wide zone of loose well-vascularized tissue. Attached to the latter are small pieces of brain tissue. Within the meninges are numerous histiocytes containing bacilli.

Other organs. The histologic studies did not clearly identify tissues from the nose and larynx.

Histochemical observations of dermal lipid. A specimen of a formalin-fixed skin lesion was submitted to Frank B. Johnson, M.D., Chief of the Histochemical Branch, Armed Forces Institute of Pathology, who reported as follows:

> Frozen sections of formalin-fixed tissues were stained by the following procedures: oil red O in propylene glycol, oil red O in propylene glycol followed by osmium tetroxide, periodic acid-Schiff, acid-fast with picric acid counterstain, and Baker's acid hematin. An additional frozen section was extracted with pyridine at 60°C for 48 hours prior to chromation for the Baker acid hematin method.
>
> Oil red O imparts definite red staining, typical for the presence of lipid which is liquid at room temperature. In the slides treated sequentially with oil red O and osmium tetroxide, there is variable greying of the red staining, indicative of the presence of unsaturated liquid. The material has an affinity for acid-fast stain in keeping with partially oxidized and polymerized unsaturated lipid. The periodic acid-Schiff procedure is positive. The Baker's acid hematin results in distinct blue staining, characteristic of phospholipid. This staining is not present in the section which was extracted with pyridine which removes phospholipids. I conclude that the principal lipid present is phospholipid.

Comment on the histopathologic observations. The histopathologic studies made on this armadillo reveal that the morphology of the lesions observed in the various tissues and organs are basically similar to those of advanced human lepromatous leprosy. The salient features of similarity are the appearance of the infected histiocytes ("lepra" cells), the small and giant globi, the distinct tendency to invade peripheral nerves, and the severe involvement of a peripheral lymph node.

The process, even in the skin lesions, is histopathologically more severe than usually observed long-standing, advanced, human lepromatous leprosy. Although in human leprosy, a few clusters of histiocytes containing bacilli may, occasionally, be observed within the lungs, we do not know (3) of any reports of leprotic pneumonitis. The prosector (WFK) had observed macroscopic areas of consolidation in the lungs of this armadillo. The demonstration of *M. leprae* in renal biopsy specimens has been observed (4) in human leprosy. Also, we are not aware, in human leprosy, of reports of esophageal or meningeal involvement, as was seen in this animal.

Although some involvement of bone marrow is usually observed in human lepromatous leprosy, the degree and distribution of involvement in this animal far exceeds, with the exception of leprotic osteitis occasionally seen in digits, the lesions of the bone marrow in the human disease.

In this animal, intraneural involvement of a large peripheral nerve is observed in only a few cells of a peroneal nerve. In advanced human lepromatous leprosy, severe involvement of the large peripheral nerves generally occurs. In experimental *M. leprae* infections in rodents, nerve involvement (10), even in inoculated foot pads, is rarely seen before the end of the first year, and spread to larger nerves of the extremities occurs later. The absence of severe intraneural infection of the larger nerves in this armadillo, probably is related to the relatively short period of seventeen months between inoculation and death.

The finding of isolated or small clusters of bacilli in pancreas, heart, diaphragm, stomach, and small intestine is comparable to observations made in active, advanced, human lepromatous leprosy.

In this animal, there was no evidence that striated muscle cells were selectively invaded (6).

Numbers and survival of *M. leprae* in autopsy material. Data on bacterial numbers in various organs and tissues are sum-

TABLE 1. *Number of* M. leprae *per gram of autopsy material.*

Right earlobe	2.0×10^{10} (7)
Lymph node (groin)	8.9×10^{9} (15)
Spleen	6.6×10^{9} (21)
Brain	6.2×10^{5} (38)
Uninoculated skin	1.1×10^{9} (12)
Lung	3.9×10^{8} (12)
Liver	2.2×10^{8} (33)

Numbers in parentheses are Morphological Indices.

marized in Table 1. Also shown are the Morphological Indices of the bacteria in the various locations, ranging from 7 in the right earlobe to 38 in the brain. It is of interest to recall that the Morphologic Index of the infecting inoculum was 3. The bacterial numbers per gram of tissue ranged from 6.2×10^5 in the brain to 2.0×10^{10} in the right earlobe.

Because brain involvement was not established histopathologically, it is probable that the bacilli counted in the suspension came from adherent meninges. Data on the viability of the bacteria in the various tissues are summarized in Table 2. The bacterial harvests from the mouse foot pads were made six months after inoculation of the bacteria from the different sites. Harvests from five foot pads were pooled for counting. Multiplication in the foot pads of the bacteria obtained from inoculated and uninoculated skin, a lymph node and the liver was of a magnitude similar to that ordinarily found with bacteria from untreated cases of lepromatous leprosy in man. At six months, no evidence of bacterial multiplication in mouse foot pads was obtained with the suspensions prepared from spleen, lung, and brain. Since only part of the mice originally inoculated with the bacteria obtained from the different sites have been evaluated at the present writing, additional data will be available at a later date.

DISCUSSION

The histopathologic and bacteriologic post-mortem findings on armadillo No. 8 ([5]), give clear evidence that the infection in this animal had become a severe, systemic disease, probably as the result of vascular seeding. With the exception of the central nervous system, leprosy bacilli seem to have been trapped in the skin, the foot pads, and in practically all organs; especially the lymph nodes, liver, spleen, bone marrow, and lungs. The numbers of leprosy bacilli in some of the tissues are very large and based on the assumption that 1 mg of *M. leprae* contains 500×10^6 leprosy bacilli (wet weight), it may be calculated from Table 1 that 1 gm of earlobe contained 40

TABLE 2. *Multiplication of* M. leprae *from autopsy tissue of armadillo No. 8 in the mouse foot pads.*

Tissue origin of bacteria	Number of bacteria inoculated per foot pad	Number of bacilli harvested per foot pad after six months
Inoculated skin (right abdomen)	1.2×10^4	9.8×10^5
Uninoculated normal appearing skin	1.0×10^4	1.4×10^6
Liver	1.6×10^4	9.1×10^5
Spleen	1.0×10^4	5.8×10^3
Lung	1.2×10^4	5.6×10^3
Brain	1.0×10^4	**0**
Inguinal lymph node	1.5×10^4	1.1×10^6

mg (4% leprosy bacilli, by weight). Figures for the bacterial loads in one gram of some of the other tissues from this armadillo are as follows: lymph node, 17.8 mg (1.78%); spleen, 13.2 mg (1.32%); uninoculated skin, 2.2 mg (0.22%); lung, 0.78 mg (0.078%); and liver, 0.44 mg (0.044%).

By comparison, skin biopsies of untreated cases of lepromatous leprosy received at Carville, contain from 10^7 to 10^8 bacilli per gram (0.02 to 0.2 mg of bacilli).

The Morphologic Indices of the leprosy bacilli from the various organs were much higher than ordinarily found in human leprosy.

In this armadillo, the lepromatoid disease in viscera was much more severe and progressed much more rapidly than lepromatous leprosy in man, therefore, appearing to indicate that this armadillo was immunologically much more susceptible to *M. leprae* than man—its natural host. Conclusions on the role of temperature in the development of leprosy in the armadillo, obviously, must await much more study and experience with the armadillo as an experimental model for human leprosy.

Multiplication in the mouse foot pad was obtained with bacteria from the inoculated and uninoculated skin, the liver, and inguinal lymph node. One might have expected that the bacteria from spleen and lung would likewise have been able to multiply in the mouse foot pad, because one must assume, that the temperature in these latter two organs is similar to that of the other viscera.

It is noted above that the leprosy bacilli found in a suspension prepared from the brain may have originated from the heavily infected meninges. Thorough search failed to locate bacilli in either nerve cells or neuroglia. Failure to find leprosy bacilli in the central nervous system in humans has been reported by Ermakova (2). Nevertheless, there are apparently authentic instances in which a few acid-fast bacilli have found their way into the central nervous system. Uhlenhut (9) reported their occurrence in the anterior horn cells of the spinal cord and in the Purkinje cells of the cerebellum.

As is so frequently the case in active lepromatous leprosy in persons not under drug treatment, acid-fast bacteria were seen in the blood macrophages of this armadillo. They were observed either as single rods or in small clumps in approximately five percent of these cells.

SUMMARY

The histopathologic and bacteriologic observations made on an armadillo that had been inoculated intracutaneously (in the ears and the abdomen, 520 days earlier) are reported. The histologic studies show that the animal had a severe disseminated leprotic disease, involving skin, bone marrow, liver, spleen, lymph nodes, lung, meninges, and eye. The invasion of nerves, the appearance of the "lepra" cells, and the presence of small and giant globi were features typical for lepromatous leprosy. Differing from lepromatous leprosy were the presence of leprotic pneumonitis, leprotic meningitis, severe widespread bone marrow infection, and esophageal involvement.

The yields by weight and count of leprosy bacilli in many tissues were far greater than in human lepromatous tissues. The highest concentration, 2.0×10^{10} per gram was in the earlobe. Bacilli from the skin and lymph node of the armadillo inoculated into the foot pads of mice showed excellent multiplication after six months.

Conclusions on the role of body temperature in the development of the rapid and severe lepromatoid disease in armadillo No. 8 must await much more study and experience in the immunology and natural susceptibility of the armadillo as an experimental model for human leprosy.

RESUMEN

Se comunican las observaciones histopatológicas y bacteriológicas efectuadas en un armadillo que había sido inoculado por vía intracutánea (en las orejas y en el abdomen) 520 días antes. Los estudios histológicos muestran que el animal tenía una enfermedad leprótica diseminada grave, que comprometía la piel, la médula ósea, el hígado, el bazo, los ganglios linfáticos, los pulmones, las meninges y los ojos. La invasión de los nervios, la aparición de células de "lepra" y la presencia de globis pequeños y gigantes fueron caracter-

ísticas típicas de lepra lepromatosa. A diferencia de la lepra lepromatosa, se observó la presencia de neumonitis leprótica, meningitis leprótica, infección grave y diseminada de la médula ósea y compromiso esofágico.

El rendimiento de bacilos de lepra, por peso y por recuento, en muchos tejidos fué muy superior al de los tejidos lepromatosos humanos. La mayor concentración, 2.0 x 10^{10} por gramo, estaba en el lóbulo del pabellón auricular. Los bacilos obtenidos de la piel y de los ganglios linfáticos del armadillo inoculados en las patas de ratones mostraron una multiplicación excelente después de seis meses.

Las conclusiones sobre el papel de la temperatura corporal en el desarrollo de la enfermedad lepromatoide rápida y grave en el armadillo N^0 8 deben esperar mayores estudios y mayor experiencia en la inmunología y en la susceptibilidad natural del armadillo como modelo experimental para la lepra humana.

RÉSUMÉ

On relate ici les observations histopathologiques et bactériologiques effectuées sur un armadillo qui avait été inoculé par voie intracutanée, au niveau des oreilles et de l'abdomen, 520 jours auparavant. Les études histologiques ont montré que l'animal présentait une dissémination grave de la maladie léprotique, avec atteinte de la peau, de la moëlle osseuse, du foie, de la rate, des ganglions lymphatiques, des méninges, des poumons et de l'oeil. L'invasion des nerfs, l'apparition de cellules lépreuses, et la présence de globi petits et de globi géants, constituaient des caractéristiques typiques de la lèpre lépromateuse. Néanmoins, la présence de pneumonite léprotiques, de méningite léprotique, ainsi que d'une infection grave et largement disséminée de la moëlle osseuse et d'une atteinte oesophagienne, constituaient des caractéristiques différentes de la lèpre lépromateuse. La quantité de bacilles de la lèpre, soit en poids, soit en nombre, libérés dans de nombreux tissus était considérablement supérieure à celle que l'on observe dans les tissus lépromateux humains. La concentration la plus élevée, 2.0 X 10^{10} par gramme, a été constatée an uiveau du lobe de l'oreille. Des bacilles récoltés au niveau de la peau et des ganglions lymphatiques de l'armadillo, et inoculés dans le coussinet plantaire de la souris, ont montré une excellente multiplication au bout de 6 mois.

Les conclusions tirées de cette étude, concernant le rôle de la température corporelle sur le développement d'une affection lépromatoïde rapide et grave chez l'armadillo n^0 8, doivent être tenues en réserve jusqu'à ce que des études complémentaires soient menées, et plus d'expérience acquise concernant l'immunologie et la susceptibilité naturelle de l'armadillo comme modèle expérimental pour la lèpre humaine.

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