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CHARACTERISTICS OF STELLATE INCLUSIONS IN GIANT CELLS AND THE ASSOCIATED TISSUE REACTIONS *

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This paper reports the study of 31 cases in the tissues of which stellate inclusions in giant cells were demonstrated. Both surgical and necropsy material was included. These cases are listed in Tables I and II.

Goldmann [1] described stellate inclusions in giant cells in 1890. In 1911, Wolbach,[2] in a report of 5 cases, attempted to clarify the nature of these structures and noted their staining reactions in detail. These inclusions—also known as spiculated or asteroid bodies—have been variously thought to be fibrin derivatives (Wolbach), fat crystals (Goldmann), undeveloped spores and filaments of a mold (Ribbert [3]), hypertrophied centrosomes (De Buck and Broeckaert [4]), elastic tissue (Vogel [5] and Letulle [6]), astrospheres (Iwanzoff [7]), and protein derivatives around a lipin core (Herxheimer and Roth [8]). Hirsch,[9] in 1935, reported 36 cases in which he found stellate inclusions in giant cells. He produced "rosette" bodies resembling stellate inclusions by the intravenous injection of a lipin extracted from human omentum, to which he had added cholesterol, stearin, and palmitin. He concluded that "radial inclusions of giant cells observed in tubercle-like granulation tissues are crystalline forms of fats solid at body temperature, such as palmitin or stearin, separated from an oil system containing cholesterol or substances with the physical properties of cholesterol." Friedman,[10] in 1944, reported a case of sarcoid of the spleen in which he found stellate inclusions and, in reviewing the literature, pointed out the frequent finding of these bodies in sarcoid lesions. He concluded that "the asteroid *may* be nonspecific but is characteristically found in sarcoid lesions."

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In view of the renewed interest in sarcoidosis, the present material has been studied (1) to delineate further the histochemical and physical characteristics of stellate inclusions and (2) to categorize the types of associated tissue reactions.

Histochemical and Physical Characteristics of Stellate Inclusions

In this material, stellate inclusions were found only in giant cells. Some of these giant cells contained sudanophilic material in the cytoplasm around the inclusion; others did not. The size of the bodies varied between 10 and 25 μ. They were readily seen in reduced light, in either unstained paraffin or frozen sections. They did not dissolve in 10 per cent potassium hydroxide and resisted 10 per cent formic and hydrochloric acid almost as well as the cytoplasm of the parent giant cell. These inclusions were not soluble in water, ether, chloroform, alcohol, benzene, xylene, acetone, or gasoline. They were isotropic in polarized light.

When stained by the hematoxylin and eosin method after formaldehyde fixation, they were red or pink. After primary fixation in Zenker's fluid and phosphotungstic acid hematoxylin staining, the spines were dark blue or purple and the central core orange-brown, although in many instances this orange core was absent. After other fixatives, the phosphotungstic acid hematoxylin stain gave variable results. Stains for lipids and fatty acid were uniformly negative. Among the stains used were Sudan III, scarlet red, Nile blue sulfate, Fischler's stain for fatty acid, Sudan black, osmic acid, and the plasmal reaction. When tested for carbohydrate, using the periodic acid-Schiff's reagent method, the inclusions remained colorless. The von Kossa test for calcium gave negative results. The Berlin blue reaction for ferric iron failed to stain the inclusion. In tests for collagen, Masson's trichrome stain and Mallory's connective tissue stain showed negative results. Wilder's stain for reticulum was uniformly negative. Tests for elastic tissue were not consistent. Using orcein, very little color was found in the inclusion and the reaction was considered doubtful. Using Weigert's elastic tissue stain, some stellate inclusions took a black stain, but the result was inconstant. (Other investigators [5,8,10] have reported negative results when using Weigert's method and positive findings when safranine and fuchsin were used.) The Fuelgen test for desoxyribosenucleic acid yielded a negative result. The Ziehl-Neelsen method did not stain the inclusions.

In order to test the resistance of the stellate inclusions to heat, sections from 2 cases (one fixed in formaldehyde and stained by the van

Gieson elastic tissue method, the other fixed in Zenker's solution and stained with phosphotungstic acid hematoxylin) were photographed under high power and then placed in a muffle furnace, using a thermocouple to control the heat. The temperature was raised to 250° C., requiring 25 minutes. After cooling, they were re-examined under direct illumination and photographed. The same sections were again placed in the furnace and this time the temperature was brought to 350° C. The time required to do this was 30 minutes, after which they were again observed under direct illumination and photographed. At 250° C. the stellate inclusions showed little change, either by direct observation or by comparison of photographs. At 350° C. there was some distortion, but the stellate form was readily recognizable and well preserved. Also, unstained paraffin sections were brought down to water and the inclusions visualized and marked. The sections were then placed in the muffle furnace and the temperature raised to 650° C. in increments of approximately 70° every 5 minutes. After cooling, a coverslip was applied and sealed around the edges with paraffin. The sections were then examined in direct light and by dark-field illumination. The giant cell outlines were recognized readily, particularly in the dark field, but the stellate inclusions had disappeared completely.

Analysis of Tissue Reactions

The tissue reactions associated with these inclusions are inflammatory and protean. However, if allowance is made for minor variations and overlapping, it is possible to classify them into three main types: (1) foreign body reactions, (2) tuberculoid granulomatous inflammation, and (3) acute and chronic inflammation and repair. Each group is discussed separately.

Foreign Body Reactions

The foreign body reaction is well recognized and amply described in textbooks of pathology. It is characterized by multinucleated giant cells surrounding or engulfing foreign or ectopic material. There is an associated acute or chronic inflammatory reaction, depending on the age of the lesion. Of the 31 cases listed in Tables I and II, 18 showed reactions of this type, and in each instance foreign or ectopic material was demonstrated. The "foreign bodies" included catgut sutures (cases 4, 14, 26, and 29), sodium urate crystals (case 17), ectopic hair, sebaceous material, and/or keratinized débris (cases 19 and 20), degenerated Blastomyces (case 11), and an unidentified foreign body (case 24). In 6 cases, an old area of hemorrhage with tissue necrosis, either with or without the deposition of cholesterol crystals, acted as

TABLE I

Necropsy Material with Stellate Inclusions in Giant Cells

Case no.	Age Sex Race	Anatomical diagnosis	Site	Type of tissue reaction
1	50 F W	Tetanus	Lungs	Perivascular and peribronchial fibrosis with lymphocytic and plasma cell infiltration; intermingled vacuolated macrophages and multinucleated giant cells
2	63 M W	Squamous cell carcinoma, grade 3, left arm (shoulder girdle amputation); metastasis to lymph nodes, lungs, jejunum, and periosteum; lobular pneumonia	Mediastinal lymph nodes	Hemosiderin-laden macrophages in peripheral sinuses; occasional foci of necrosis in the medulla, with scattered vacuolated multinucleated giant cells
3	53 M W	Carcinoma of bladder with extension to prostate and metastasis to pelvic lymph nodes	Tracheal lymph node	Small hyalinized scar in the periphery of the node; multinucleated giant cells in adjacent lympho-reticular tissue
4	65 F W	Periarteritis nodosa	Mesentery (site of previous biopsy)	Catgut suture material surrounded by scar tissue in which there are lymphocytes and multinucleated giant cells
5	36 M W	Sarcoidosis involving heart, liver, lungs, lymph nodes; clinical heart block with Stokes-Adams syndrome	Heart, liver, lung	Tubercle-like collections of epithelioid cells with multinucleated giant cells; older lesions showing intense hyaline scarring and giant cells; (stains for acid-fast organisms negative)
6	41 M W	Glioblastoma multiforme; acute bronchitis; lobular pneumonia	Peribronchial lymph node	Small peripheral hyaline scar with multinucleated giant cells in adjacent lympho-reticular tissue
7	53 M W	Pontine hemorrhage, massive; lobular pneumonia; healed gastrojejunostomy and entero-enterostomy	Peripancreatic and perigastric lymph nodes	Medullary and peripheral sinuses filled with lymphocytes, plasma cells, and eosinophilic polymorphonuclears; scattered multinucleated giant cells with vacuolated cytoplasm in the medulla; (Sudan IV and Scharlach R stains positive)
8	58 F C	Leiomyosarcoma of uterus with local extension and metastasis to lungs and liver	Heart	Small area of subepicardial hyaline scar tissue replacement of heart muscle; in this area, a few lymphocytes and numerous multinucleated giant cells
9	77 M W	Coronary occlusion; pulmonary edema and lobular pneumonia	Mediastinal lymph node	Tubercle-like collections of epithelioid cells without caseation and with scattered multinucleated giant cells; (stains for acid-fast organisms negative)
10	44 M W	Acute alcoholism; fat embolism(?)	Lymph node in gastro-hepatic ligament	Large vacuoles scattered throughout lymph node; collections of vacuolated macrophages, eosinophilic polymorphonuclears and multinucleated giant cells around the vacuoles
11	80 M W	Lobular pneumonia (gram-positive cocci); focal blastomycotic nodules with fibrosis	Lung	Old hyalinized scar with lymphocytic infiltration and multinucleated giant cells with ingested degenerated Blastomyces
12	66 F W	Tuberculosis involving bladder, ureters, kidneys, spleen, and liver	Liver	Periportal spaces with numerous lymphocytes and plasma cells, slight increase in connective tissue, scattered multinucleated giant cells; (stains for acid-fast organisms positive)

the foreign body (cases 2, 18, 25, 27, 28, and 31). In the 3 remaining cases (7, 10, and 15), ectopic fat was found in association with reactions of this type.

Tuberculoid Granulomatous Inflammation

Tuberculoid granulomatous inflammation is characterized by the presence of discrete tubercle-like structures made up of radially arranged epithelioid cells. In some instances typical caseation is seen; in others there is a peculiar type of fibrinoid necrosis. Multinucleated giant cells with varying numbers of nuclei are seen, situated either centrally or peripherally in the granuloma. Older lesions show varying degrees of hyalinization. There were 8 examples of tissue reaction of this type in the 31 cases studied. Four of these were diagnosed as sarcoidosis on the basis of the histologic findings and supporting clinical evidence. Two (cases 9 and 21) showed tubercle-like structures without central necrosis, but these represented isolated findings without clinical confirmation. In the second of these (case 21) there was at least reasonable suspicion that some impregnated foreign material, no longer demonstrable, was the cause of the tissue reaction. The seventh example (case 30) showed an outer zone with epithelioid proliferation, numerous multinucleated giant cells with stellate inclusions, and an extensive zone of central necrosis. Despite careful clinical and histologic study, no etiologic agent could be proved. Finally, case 12 was an established case of tuberculosis in which stellate inclusions were found in several giant cells.

Acute and Chronic Inflammation and Repair

Acute and chronic inflammation and repair comprise a tissue reaction which is harder to define and is more variable than the two preceding types. It is characterized by a cellular infiltration of polymorphonuclear leukocytes, lymphocytes, plasma cells, and monocytes in varying proportions. The giant cells are similar to those in the other two types but are usually less numerous. In some of the older lesions the inflammatory cell response is markedly diminished and the picture is essentially that of a hyaline scar with a few peripherally situated giant cells with inclusions. Five examples (cases 1, 3, 6, 8, and 23) of this type of reaction are included in this group of 31 cases.

Discussion

Studies of the physical and chemical characteristics of stellate inclusions have given further information. The staining reactions indicate that stellate inclusions do not contain stainable carbohydrate, des-

TABLE II

Surgical Material with Stellate Inclusions in Giant Cells

Case no.	Age Sex Race	Diagnosis	Site	Type of tissue reaction
13	48 F W	Sarcoid	Skin, forehead	Tuberculoid granulomatous inflammation without caseation
14	32 F W	Postoperative adhesions	Old operative site in pelvis	Foreign body giant cell reaction around catgut sutures
15	? F W	Carcinoma of breast without axillary metastasis	Axillary lymph node	Beneath peripheral sinuses, large vacuoles collared by epithelioid cells and multinucleated giant cells
16	39 F C	Sarcoidosis	Cervical lymph node	Tuberculoid granulomatous inflammation without caseation
17	52 M W	Gout	Triceps tendon	Foreign body reaction to sodium urate crystals
18	26 M W	Interposition of muscle fragments	Soft tissue between fractured ends of tibia	Fragments of degenerated striated muscle, areas of old hemorrhage and repair with chronic inflammation and numerous scattered multinucleated giant cells
19	? F W	Dermoid	Ovary	Foreign body giant cell reaction around ectopic hair and sebaceous material
20	? F W	Dermoid	Ovary	Same as above
21	33 M C	Sarcoid	Postauricular lymph node	Tuberculoid granulomatous inflammation without caseation

22	27 F W	Sarcoid(?)	Skin, forehead (scar from old injury)	Tuberculoid granulomatous inflammation without caseation; laminated and partially calcified bodies also found in giant cells
23	60 F W	Bronchiectasis	Lung	Peribronchial fibrosis, lymphocytic and plasma cell infiltration, scattered giant cells with vacuolated cytoplasm
24	40 F C	Foreign body granuloma	Lip (history of injury with dental drill)	Heavy plasma cell and lymphocyte infiltration of subepithelial connective tissue, with scattered multinucleated giant cells and ingested unidentified foreign material
25	49 M C	Synovial fibrosarcoma	Periarticular connective tissue, left foot	Old hemorrhage with hemosiderin- and fat-laden macrophages, fibrous repair, and scattered multinucleated giant cells
26	36 F W	Retained suture and foreign body giant cell reaction	Fallopian tube	Acute and chronic inflammation and foreign body giant cells around old catgut suture
27	28 F W	Simple adenoma with old hemorrhage	Thyroid	Numerous hemosiderin-laden macrophages, cholesterol clefts, foreign body giant cells
28	? F W	Endometriosis	Ovary	Old hemorrhage with cholesterol clefts, and foreign body giant cells around these clefts
29	34 F W	Uterus with old operative surface adhesions	Uterus	Surface adhesions with catgut suture surrounded and partially engulfed by foreign body giant cells, scattered lymphocytes and plasma cells
30	29 M W	Tuberculosis(?)	Inguinal lymph node	Focal areas of caseation necrosis, peripheral epithelioid cells and giant cells; (stains for acid-fast organisms negative)
31	64 F W	Intraductal papillomas with old hemorrhage	Breast	Giant cells around cholesterol clefts; scattered macrophages with ingested hemosiderin and fat

oxyribosenucleic acid, fat, ferric iron, or calcium. They are best visualized by using the phosphotungstic acid hematoxylin staining method, as other investigators have shown. They are readily seen in routine hematoxylin and eosin sections. Hirsch [9] is of the opinion that the stellate inclusions represent an altered lipid. The inability to demonstrate stainable lipid suggests that certain chemical changes in the composition of the crystals take place in the tissue so that they become insoluble in fat solvents, and that further changes or additions produce the elastin-like staining qualities. The experiment undertaken to test the resistance of these inclusions to heat indicates that they resist temperatures up to 350° C. with little change. The melting points of the two lipids suggested by Hirsch—stearin and palmitin—are between 65° and 70° C., and therefore it would appear that these bodies are not simple stearin or palmitin crystals. The addition of protein and the formation of a complex lipoprotein is possible. The melting point of this theoretic lipoprotein is not known; consequently it is not possible, on the basis of this new information, to deny such a chemical composition. It seems highly improbable, however, that heat of 350° C. would not materially affect the structure and crystalline form of such a compound.

Micro-incineration at 650° C. results in the complete decomposition of the inclusions. This indicates the organic nature of the structures. If inorganic substances are present, the amounts must be minute. The staining reactions, resistance to heat, and resistance to weak acids and alkalis suggest that these inclusions are made up essentially of protein.

The present study of the tissue reactions associated with giant cells containing stellate inclusions has shown that the most frequent type is the foreign body reaction. Eighteen (58 per cent) of the 31 cases studied are classified under this heading. The types of "foreign bodies" encountered are diverse, with no obvious common physical or chemical characteristics except their ability to produce this type of response.

It was thought worth while to review the literature to check the validity of the present division of the tissue reactions into three types. There are 75 cases reported in which these inclusions are found in giant cells. Of these, 62 are described adequately enough to allow grouping according to the tissue reaction. Thirty-two cases are examples of foreign body reaction and are listed in Table III. The frequency of this type of reaction, with the great diversity of foreign bodies, is strong evidence that these inclusions are not specific for any disease entity.

The next most frequently encountered type of reaction was that listed as tuberculoid granulomatous inflammation. This designation was selected primarily because it is descriptive and does not imply a single etiologic agent. There were 8 examples of response of this type in my material. In only one (case 12) was it possible to demonstrate

TABLE III

Thirty-Two Cases from the Literature of Foreign Body Reaction with Stellate Inclusions in Giant Cells

No. of cases	Type of material	Author
2	Oil (aspiration)	Hirsch[9]
4	Paraffin (injection)	De Buck and Broeckaert,[4] Hirsch,[9] Firket[17]
7	Catgut suture	Hirsch[9]
6	Sebaceous material, hair, desquamated epithelial	Goldmann,[1] Herxheimer and Roth,[8] Hirsch[9]
2	Retained secretion (breast)	Letulle,[6] Hirsch[9]
1	Asbestos	Skavlem and Ritterhoff[18]*
8	Necrotic tissue, cholesterol crystals, old hemorrhage	Hirsch,[9] Firket[17]
2	Ectopic fat	Hirsch[9]

* Coexistent sarcoidosis.

the etiologic agent. The other 7 cases were diagnosed as either sarcoidosis or granulomatous inflammation of unknown etiology. In the literature it is possible to find 21 cases in which this tissue reaction is seen in association with giant cells containing stellate inclusions. These are listed in Table IV.

It is of interest to note that of the 21 cases of granulomatous inflammation in the literature, 12 were diagnosed as sarcoidosis; and that of the 8 cases in my material, 4 were so labeled. This diagnosis in most instances rests on histologic and clinical findings of doubtful specificity. The histologic basis for the diagnosis of sarcoidosis depends on minor variations in structure of the tubercle-like granuloma. Attempts have been made by Robb-Smith [11] and Dutra [12] to differentiate certain of these granulomas on morphologic grounds. Such features as the absence of necrosis, degree of fibrosis, size of the giant cells and their position in the granuloma, the distribution of reticulum, and the presence or absence of stellate inclusions have been suggested as useful in separating Stengel-Wolbach's sclerosis and beryllium granulomatosis from sarcoidosis. Lever and Freiman [13] and Kay,[14] using the features

suggested by Robb-Smith, were unable to distinguish between Stengel-Wolbach's sclerosis and sarcoidosis, and in fact concluded that these are the same disease. More recently Silverman and Erickson [15] concluded that the separation of sarcoidosis of the Darier-Roussy type and subcutaneous beryllium granulomatosis on morphologic grounds is

TABLE IV

Twenty-One Cases from the Literature of Tuberculoid Granulomatous Inflammation with Stellate Inclusions in Giant Cells

No. of cases	Organ involved	Diagnosis	Author
1	Spleen	Sarcoidosis	Friedman[10]
4	Spleen	Sarcoidosis	Kay[14]
1	Lung	Sarcoidosis	Nickerson[22]
1	Skin	Sarcoidosis	Lever and Freiman[13]
1	Skin	Sarcoidosis	Winkler[26]
1	Skin	Lupus pernio	Herxheimer and Roth[8]
1	Skin	Sarcoidosis	Jadassohn[19]
1	Skin	Foreign body granuloma	Diss[20]
1	Skin	Sarcoid (Darier-Roussy)	Görl[21]
1	Skin	Tuberculosis	Herxheimer and Roth[8]
1	Spleen, liver, lymph nodes	?	Wolbach[2]
1	Lungs, spleen, liver	?	Wolbach[2]
1	Lungs, lymph nodes	Oil aspiration	Hirsch[9]
1	Parabronchial lymph nodes	Tuberculosis	Hirsch[9]
1	Lungs	Bronchiolitis obliterans	Frothingham[23]
2	Spleen	Sarcoidosis(?)	Mallory[24]
1	Lungs	Sarcoidosis and asbestosis	Skavlem and Ritterhoff[18]

highly dubious. It is extremely doubtful in my opinion whether the lesions of tuberculoid leprosy, productive tuberculosis, beryllium granulomatosis, sarcoidosis, some of the fungous granulomas, and other granulomas produced by certain lipids can be separated on morphologic grounds when an etiologic agent is not demonstrable. Furthermore, it is of interest that not only the histologic lesion, but also the organ distribution of systemic sarcoidosis is simulated by beryllium poisoning and by oil aspiration. Pinkerton [16] and Hirsch [9] have shown

that aspirated oils are carried in the lymphatics and produce tubercle-like granulomas, not only in the lungs, but also in the lymph nodes, liver, and spleen. Hirsch's case of oil aspiration showed stellate inclusions in the giant cells. The frequent association of stellate inclusions with foreign or ectopic material suggests that at least some cases diagnosed as sarcoidosis are examples of a non-specific inflammatory granulomatous response to any one of many local or lymphatic circulating agents or substances. Proof of this will have to await more exacting attempts to demonstrate the agent in each case.

The third type of reaction, acute and chronic inflammation and repair, differs in only minor details from the foreign body reaction. Five cases in the present material are listed under this heading. These show giant cells with inclusions and varying degrees of acute and chronic inflammation. In some lymph nodes the picture is that of hyaline scarring with giant cells containing inclusions in the adjacent lymphoreticular tissue. Nine similar cases are found in the literature and are listed in Table V.

TABLE V

Nine Cases from the Literature of Acute and Chronic Inflammation and Repair with Stellate Inclusions in Giant Cells

No. of cases	Organ involved	Diagnosis	Author
1	Lungs	Adenocarcinoma, colon	Wolbach[2]
1	Lungs	Pernicious anemia	Wolbach[2]
1	Lungs	Bronchiolitis fibrosa obliterans	Amoroso and McNally[25]
1	Lungs	Thyroidectomy (post-operative death)	Hirsch[9]
1	Lungs	Pernicious anemia	Hirsch[9]
1	Lungs	Bronchiolitis obliterans	Vogel[5]
1	Bronchial lymph node	Carcinoma of nasopharynx	Wolbach[2]
1	Uterus	Hydrosalpinx	Hirsch[9]
1	Os lunatum	Old fracture	Hirsch[9]

In the 5 cases in my study, this reaction is found in the lungs in 2 cases and in tracheal and peribronchial lymph nodes in 2 others. Of the cases listed in Table V, this reaction is found in the lungs in 6 and in a bronchial lymph node in one other case. No foreign or ectopic material was demonstrated in any of these cases, but the relatively ready access of all types of aspirated material to the lungs suggests

that at least some of these cases could be grouped as foreign body reactions.

Review of the literature appears to validate the separation of the tissue reactions associated with stellate inclusions in giant cells into three types. The combined data from the present series and from the literature are analyzed in Table VI.

TABLE VI

Data on Thirty-One Cases from the Present Series Combined with Those from Seventy-Five Cases in the Literature

	Foreign body reaction	Tuberculoid granulomatous inflammation	Inflammation and repair	Insufficient data	Total cases
Present series	18	8	5	0	31
Literature	32	21	9	13	75
Total	50	29	14	13	106

CONCLUSIONS

The staining reactions, resistance to weak acids and alkalis as well as to high temperatures, and the results of micro-incineration studies indicate that stellate inclusions are organic protein structures.

These inclusions are found in association with three types of tissue response; namely, foreign body reaction, tuberculoid granulomatous inflammation, and acute and chronic inflammation and repair.

The frequency of the association of these inclusions with foreign body reactions and the great diversity of the foreign bodies are strong evidence against these inclusions being specific for any disease entity.

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[*Illustrations follow*]

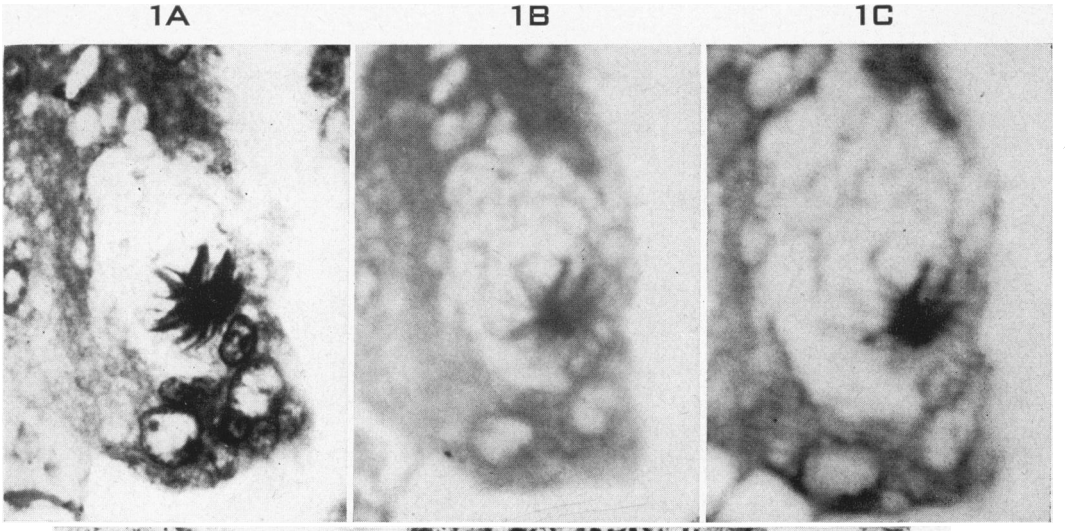
DESCRIPTION OF PLATES

PLATE 118

FIG. 1. (A) Control section before heating, showing giant cell with stellate inclusion. Phosphotungstic acid hematoxylin stain. (B) Same cell after heating to 250° C. Fading of the stain may be noted, with good preservation of the inclusion. (C) Same cell after heating to 350° C. The inclusion is distorted but the star shape and delicate spines are easily recognized.

FIG. 2. Case 19. From a dermoid cyst of the ovary. Foreign body reaction to ectopic hair and sebaceous material. The giant cell to the left of the center has two stellate inclusions.

FIG. 3. Case 17. Foreign body reaction to sodium urate. A giant cell near the center of the field has a stellate inclusion.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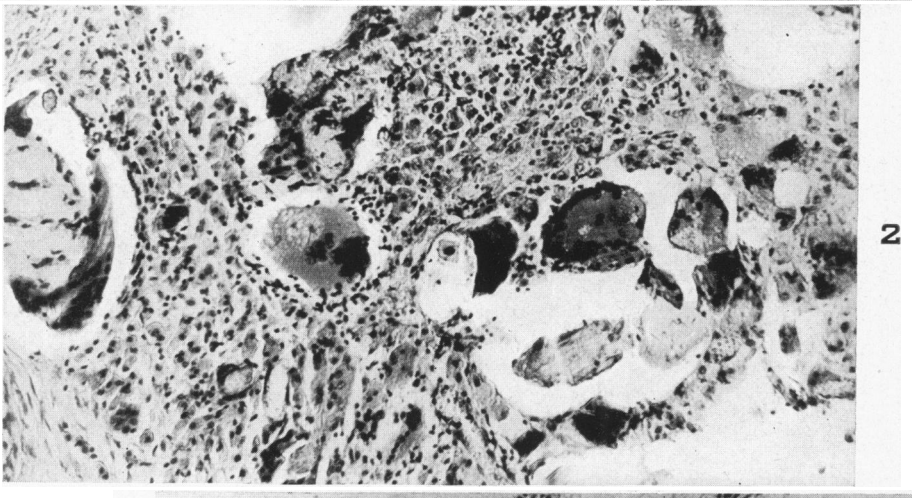
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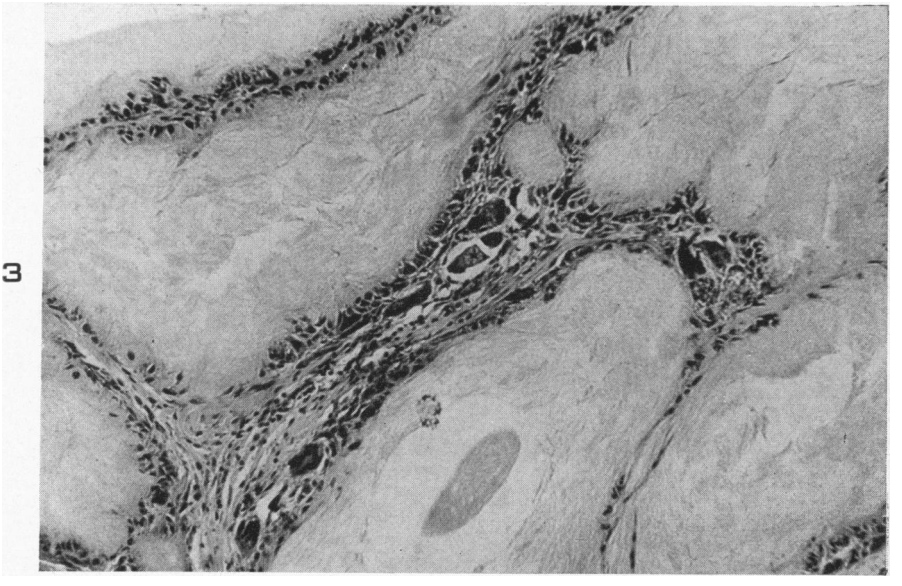
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PLATE 119

FIG. 4. Case 15. Foreign body reaction to ectopic fat. The giant cell indicated by the arrow contains a stellate inclusion, shown at a higher magnification at the upper left.

FIG. 5. Case 31. Foreign body reaction around cholesterol crystals in an area of old hemorrhage. The stellate inclusion indicated by the arrow is seen in higher magnification at the upper right.

FIG. 6. Case 30. Tuberculosis(?). Granulomatous reaction with central fibrinoid necrosis. The stellate inclusion indicated by the arrow is shown at a higher magnification at the upper left.

FIG. 7. Case 21. Sarcoid. Tuberculoid granulomatous inflammation without necrosis. A stellate inclusion is seen indistinctly to the left of and above the center of the field.

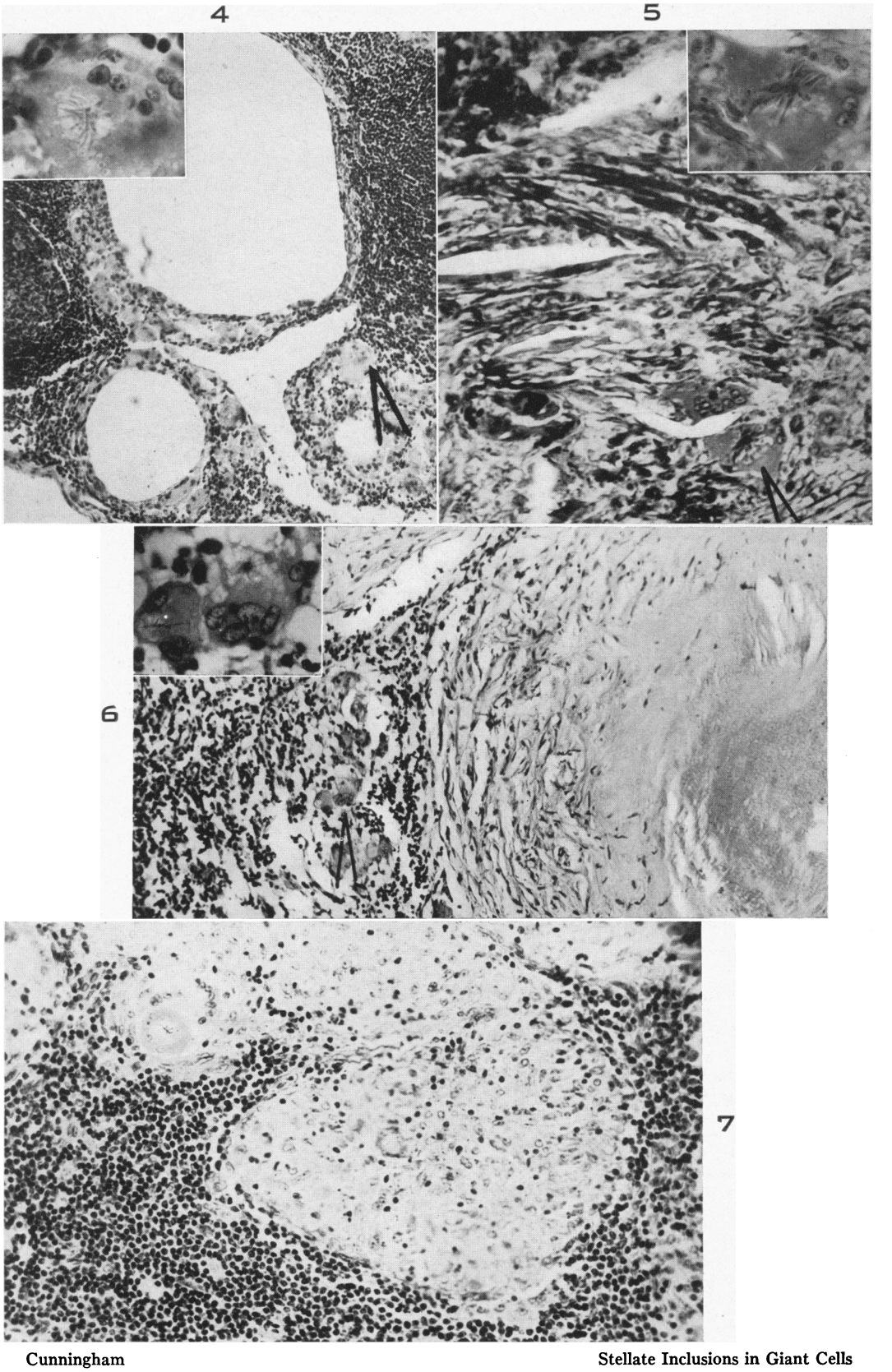
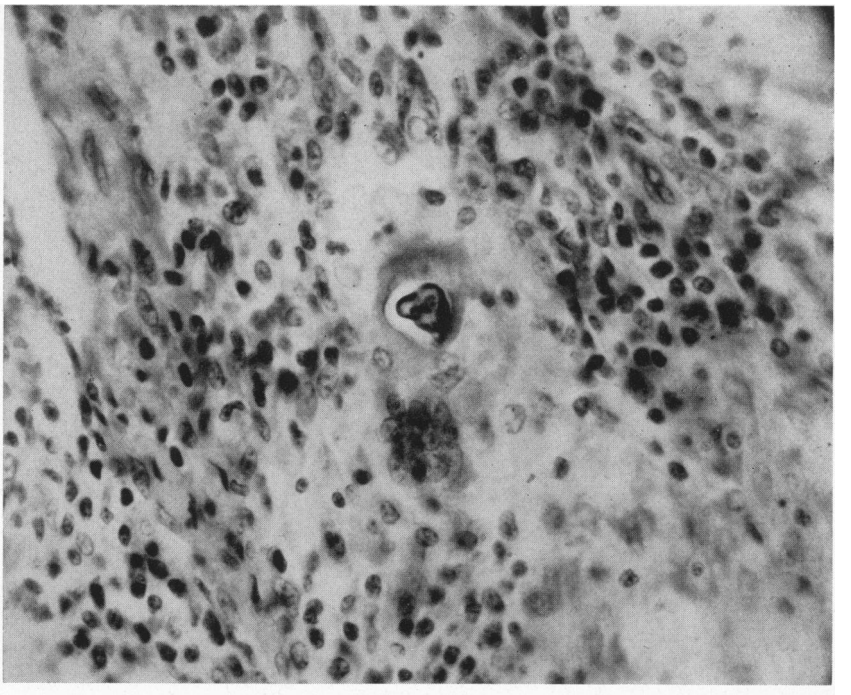

4
5
6
7

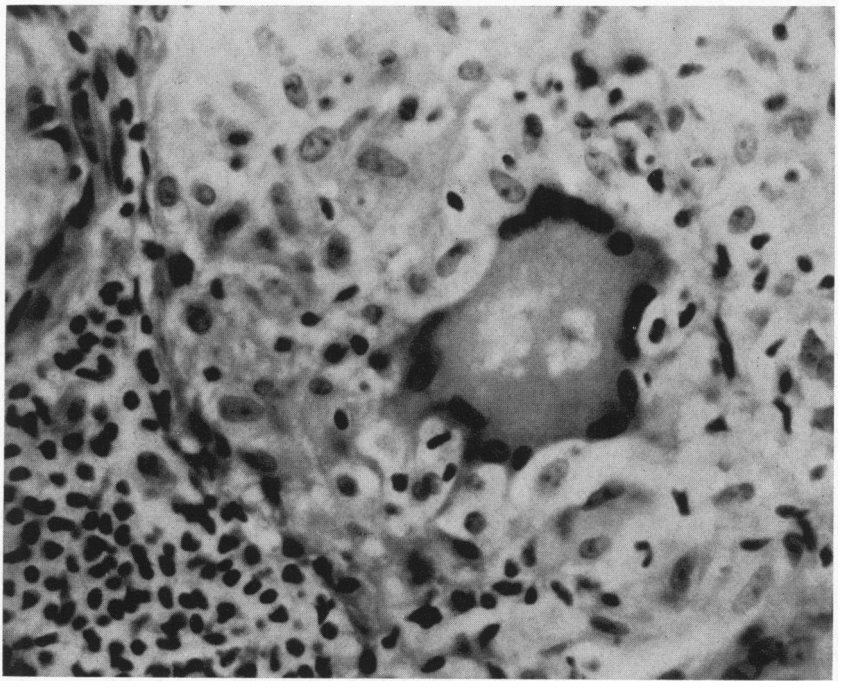
PLATE 120

FIG. 8. Case 22. Sarcoid. (A) Multinucleated giant cell with laminated (Schaumann) body. (B) Tuberculoid granulomatous reaction and central giant cell with stellate inclusion.

8 A



8 B

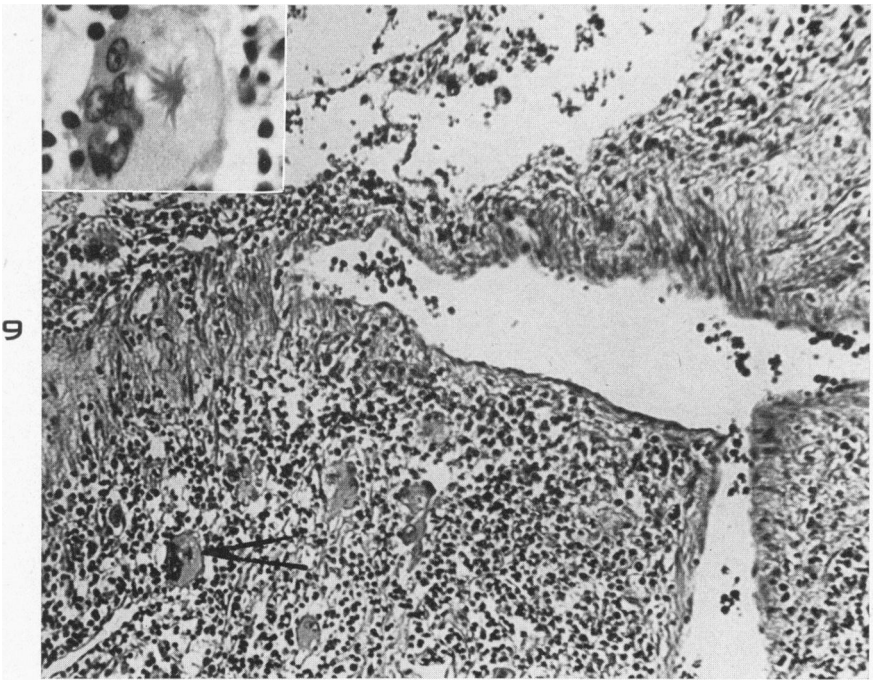


Cunningham Stellate Inclusions in Giant Cells

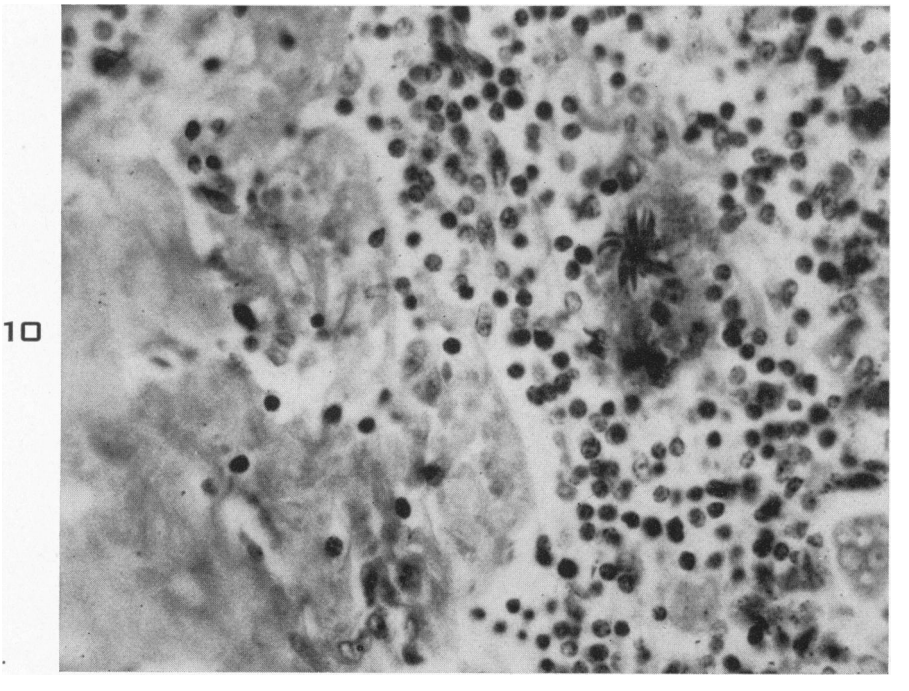
PLATE 121

FIG. 9. Case 23. Bronchiectasis. Perivascular chronic inflammation. Giant cell with stellate inclusion is seen at higher magnification in insert at upper left.

FIG. 10. Case 3. Small hyalinized scar in the periphery of a tracheal lymph node. Giant cell with stellate inclusion in the adjacent lympho-reticular tissue.



9



10

Cunningham Stellate Inclusions in Giant Cells