

Macrophage Content of Oil-Induced Peritoneal Exudate in Rats and Rabbits.* (18134)

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(Introduced by P. B. Beeson.)

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The ease with which experimental tuberculosis can be produced in guinea pigs and rabbits indicates a low degree of natural resistance to tubercle bacilli. In contrast, it is extremely difficult to produce experimental tuberculosis in the rat. A high degree of natural resistance in the rat offers an unusual opportunity to investigate problems of host resistance in an animal which in general differs from man and other animals in regard to hypersensitivity and to antibody production. The cellular defense against tuberculosis has been extensively studied by Medlar(1), Sabin *et al.*(2), and Martin *et al.*(3). It has also been shown(3,4) that polymorphonuclear leukocytes ingest tubercle bacilli, but are themselves injured early in the process. The tissue macrophage is another phagocytic cell involved in the inflammatory reaction. This cell becomes prominent later than the polymorphonuclear leukocyte in the development of inflammation, and it is not uncommon to find tubercle bacilli and dead polymorphonuclear leukocytes within the cytoplasm of the mononuclear phagocytes.

Previous studies by Doan *et al.*(5), indicated that the predominant response of the host to foreign lipids was a mobilization of mononuclear phagocytes. With this knowl-

edge at hand, the present study was undertaken in an attempt to ascertain possible quantitative differences in macrophage response in species naturally susceptible and naturally resistant to tuberculosis.

Materials and methods. A modification of the method of Lucké *et al.*(6) was employed to obtain peritoneal exudates containing mononuclear cells. Albino rats, weighing between 150 to 250 g, and albino rabbits, weighing between 2,000 to 3,000 g, were injected intraperitoneally with 25 cc of sterile mineral oil per kilo of body weight. Forty-eight hours later the animals were sacrificed; a midline incision was made and 25 cc per kilo body weight of heparinized-Tyrode solution containing 10% homologous serum was introduced into the peritoneal cavity. The incision was closed with clamps and the fluid agitated in the abdominal cavity for five minutes. The milky emulsion formed was removed with a large sterile pipette and was placed in a separatory funnel for 15 minutes. The oil layer separated sharply and the aqueous phase was removed. White blood cell and differential counts were performed on the aqueous cell suspension in the usual manner. Wright's differential blood stain was used for studying the cells of the exudate.

Results. Table I reveals that the total white blood cell response of albino rats to intraperitoneal mineral oil injection is significantly greater than that of rabbits. A comparison of cell type obtained from these 2 species reveals a higher percentage of mononuclear cells in rabbit exudates. However, the total number of mononuclear cells (Table I, absolute values) is considerably greater in the rat.

In view of the difference of opinion con-

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5. Doan, C. A., Sabin, F. R., and Forkner, C. E., *J. Exp. Med.*, (Supp. No. 3), 1930, v52, 89.

6. Lucké, B., Strumia, M., Mudd, S., McCutcheon, M., and Mudd, E. B. H., *J. Immunol.*, 1933, v24, 455.

TABLE 1. Differential and White Blood Counts on Intraperitoneal Exudates of Albino Rats and Rabbits.

Rat No.	WBC/cmm	Poly	Lymph	Eos	Baso	Mono	Absolute mono count/cmm
1	20200	61	22	3	0	17	3433
2	15900	53	30	0	0	17	2703
3	12200	21	55	0	0	22	2684
4	30450	45	33	1	0	22	6650
5	30150	62	18	5	0	15	4520
6	5050	3	30	0	0	67	3350
7	8700	1	46	0	0	52	4540
8	10550	75	8	2	0	15	1650
9	9500	57	30	1	0	13	1235
10	6800	70	5	0	0	25	1700
11	15200	59	22	0	0	19	2890
12	13300	17	17	0	1	65	8620
13	11200	22	10	0	1	67	7500
14	7100	18	5	0	3	74	5230
15	4800	6	25	0	1	68	3260
Mean	13321						3930
S.D.	±8086						±2425

Rabbit No.	WBC/cmm	Poly	Lymph	Eos	Baso	Mono	Absolute mono count/cmm
1	800	20	5	0	0	75	600
2	1100	46	9	3	0	42	462
3	550	22	33	0	0	55	310
4	550	23	12	0	0	65	357
5	1350	10	6	0	0	84	1130
6	650	70	4	0	0	26	269
7	900	45	5	0	0	50	450
8	700	56	2	0	0	42	294
9	700	45	7	0	0	48	336
10	700	43	2	0	0	55	385
11	2800	31	7	0	0	62	1735
12	1100	34	6	0	0	60	655
13	1200	10	8	0	0	82	984
14	2500	26	10	0	0	64	1600
15	1000	56	10	0	0	34	340
Mean	1114						660
S.D.	±673.5						±473.3

cerning terminology of the large mononuclear cells, we have, for the purpose of this study, used the term "mononuclear phagocyte" to include the cells which have previously been described as "macrophages," "clasmatoocyte," "histiocytes," and "monocytes." The several types of cells included in our category are illustrated in Fig. 1. It can be seen that

many of these cells have ingested the mineral oil.

Discussion. It is known that phagocytic cells similar to, if not identical with, those observed in this study are extremely important to the host in the process of natural resistance to certain infections. It is suggested that one mechanism responsible for the rat's natural resistance is this animal's ability to mobilize a larger number of mononuclear phagocytic cells than can be mobilized by less resistant animals. Further work to explore this hypothesis is in progress.

Summary. 1. Albino rats and rabbits were injected intraperitoneally with sterile mineral oil to produce peritoneal exudates.

2. Peritoneal exudates of rats contained greater numbers of white blood cells than rabbit exudates.

3. There was a significantly greater mononuclear phagocyte response to the same stimulus in rats than in rabbits. It can be postulated that this response may be related to the native resistance of the rat to tuberculosis.

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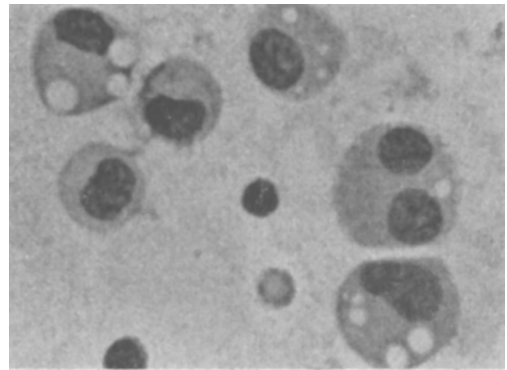


FIG. 1.
Predominant cell type in peritoneal exudate. Note phagocytosis of oil droplets.

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