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# DIPLOCOCCUS IN MICE, PULMONARY INFECTION AND CONTRIBUTORY CAUSES

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DIPLOCOCCUS IN MICE, PULMONARY INFECTION AND  
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Following is the translation of a French-language scientific paper by H. Velu, P. Soulie, R. Courtade and P. Gavaudan in Comptes Rendus de la Societe de Biologie, (Reports of the French Biological Society), Vol. 136, Paris, 1942, pages 371-72.

Among the microbes encountered during autopsy of white mice which died as a consequence of induced lesions or of improper feeding or deficient hygiene, we have frequently found a Gram-positive germ without inherent pathogenicity which presents itself in organic smears, in particular from the lung, in the form of large rounded grains of about 1 to 1.5  $\mu$ , either isolated as cocci but more generally assembled in diplococci and sometimes in short links of 3 to 4 elements. The smears either show some isolated individuals or else a very large number of elements and, in the latter case, the germs are also found abundantly in the liver and spleen as in true septicemia.

The different organs, particularly the lung, make it possible to obtain cultures of a rather polymorphous diplococcus (initially with some difficulty and subsequently more easily through reinfection) which presents the following characteristics.

In a culture medium of briny peptonized meat broth, floccules consisting of very long chains with as much as several tens of elements deposit at the bottom of the tube and leave the medium transparent. In a culture medium containing glucose, growth is abundant and the very cloudy medium becomes acidified very rapidly (final pH: 4.8). Microscopic examination shows short chains of 3-4 elements or diplococci. In a medium of horse serum, the medium remains clear and accumulations (similar to soft bread crumbs) composed of diplococci formed in the bottom of the tube. Standard agar-agar produces clear and translucent cultures with a diameter of 1 mm which subsequently become opaque. From gelatin, there are obtained fine opaque colonies along the line of inoculation without liquefaction of the medium. Culture is unsuccessful in peptonized water.

No development takes place in bile-containing media (peptonized water containing glucose with the addition of beef bile at 10 : 100 or bile salts at 1 : 250. In sugar-containing gelose with the addition of turnsole, this diplococcus becomes acidified without releasing gas. Glucose, lactose, maltose, sacchrose, dextrin, galactose, and levulose do not attack mannitol. Milk with turnsole becomes acidified and coagulated within 48 hours. The agent is not hemolytic and does not resist heating at 60° for 30 minutes.

The microorganism has no virulence whatever for mice in good condition either by intraperitoneal administration (0.2 ccm of a 24-hour culture) or by subcutaneous administration (0.5 ccm of broth culture). By irritating the lung through inhalation of chlorine at a dose of 150 milligram per cubic meter for 10 minutes which is not fatal for healthy animals under the conditions already described in an earlier communication (1), we weakened resistance in mice having inhaled an aerosol of diplococci and produced the evolution of a high degree of pulmonary congestion and true septicemia with fatal issue. Examination of the lesions shows discrete diffusion of the edematous fluid in the alveolae under the action of the chlorine; dilation of the blood-saturated capillaries (probably due to the influence of the diplococcus) which frequently obturate the alveolar lumen and produce extensive plaques of a splenetic appearance; and a superabundance of the diplococcus in the pulmonary parenchyma; the alveolar walls and the edematous fluid. The invasion is particularly heavy at the periphery of the lung where we encounter dense infectious plaques which obscure the alveolar structure. The pulmonary cell frequently phagocytizes the diplococcus which is found either isolated or in accumulation and there is practically no leucocytic reaction in the lung.

#### Summary:

A single and brief exposure to an industrial gas (chlorine) at a clinically inactive dose for the control animals, enabled us to trigger, in mice previously contaminated by a non-virulent diplococcus, a fatal pulmonary infection with septicemia through this germ. Consequently, with the aid of a contributory agent, the microorganism turned from saprophytic to virulent action as was demonstrated for streptococci under the action of sensitizing factors by S. J. Zlatagoroff et al (2), and under the influence of various irritant bacteria by H. Grossmann (3). The new findings stress the importance of treating the air in plants where healthy but germ-carrying workers are subjected to the action of irritant atmosphere.

#### References

- 1 - H. Velu, P. Soulie, and B. Bellocq. Bull. Acad. de Med., 1941, Vol. 125, p. 159.
- 2 - S. J. Zlatagoroff, B. L. Palante and M. L. Kochkine. Annales de l'Institut Pasteur, 1929, Vol. 43, p. 1645.
- 3 - H. Grossman. Zbl. f. Baktr. (Orig.). Vol. 127, p. 225.