

## AIR CARRIAGE OF PATHOGENIC AND OTHER ORGANISMS.

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IN all laboratories engaged in the preparation of serum the latter occasionally becomes contaminated by micro-organisms. It is often a matter of considerable difficulty to determine the origin of such organisms, and investigations upon the source of these contaminations not infrequently proves of considerable interest. This paper records some preliminary experiments which were designed to throw light on the subject.

The first experiments were made at a stable containing 20 horses, arranged in two equal rows separated by a wide central passage running from north to south and opening at each end of the building.

Agar plates were exposed for a period of 30 minutes as follows: six inside the stable, six, arranged in pairs, 30 feet from the open stable doors, the centre pair being opposite to the entrance with a space of 20 feet on either side between this pair and the lateral pairs.

Similar sets of six were placed at 90 feet and at 150 feet from the stable doors and control plates were placed in an open space 400 feet from any building.

The exposures were made on three dry summer days under the following meteorological conditions:

Day	Velocity of wind	Wet bulb	Dry bulb
1	normal	58° F.	60° F.
2	moderate	56° F.	58° F.
3	strong breeze	58° F.	60° F.

The table on p. 174 gives the results of the bacteriological examination of the plates after 18 hours' incubation at 37° C. The number of colonies represents the average of the six plates in each position.

The average number of colonies on the agar plates exposed at a distance of 400 feet from any building on various days was found to be six, most of them being staphylococci. Staphylococci, various species of mould and *B. subtilis* are commonly found in the fodder and bedding of the large herbivora and these organisms were presumably air borne directly from the stables.

In estimating the importance of any suspected source of bacterial contamination two methods are available, namely the identification of the bacterial population on the plate with that present at the source and the consideration of curves based upon the bacterial count obtained from plates

*Air Carriage of Organisms*

			<i>Calm day.</i>	
Situation	No. of colonies	Organisms found		
Inside stable	300	Staphylococci, moulds, gram-negative bacillus, <i>B. subtilis</i>		
30 ft. from stable	30	Staphylococci, moulds, gram-negative bacillus		
90 " "	12	Staphylococci, moulds		
150 " "	3	Staphylococci		
<i>Moderately windy.</i>				
Inside stable	800	—	—	
30 ft. from stable	55	—	—	
90 " "	23	Not ascertained		
150 " "	16	"	"	
<i>Windy day.</i>				
Inside stable	730	Staphylococci, moulds, gram-negative bacillus, <i>B. subtilis</i>		
30 ft. from stable	200	"	"	"
90 " "	90	Staphylococci, moulds, <i>B. subtilis</i>		
150 " "	40	Staphylococci, moulds		

exposed at various points in relation to the source. The point at which the curve begins to "flatten out" may be regarded as the limit of contamination from the particular point, under the conditions of the experiment.

#### PATHOGENIC ANAEROBES IN THE AIR OF STABLES, ETC.

Petri dishes containing nutrient broth were exposed in a stable for a period of six hours, on each of six successive days. The six samples after being mixed were heated at 70° C. for 30 minutes. The heated broth was then inoculated into meat tubes and incubated at 37° C. for 24 hours. Microscopical examination of the resulting cultures revealed an apparently pure growth of a gram-positive, non-motile bacillus of from 5–8 microns in length and about 1–5 microns in breadth. Subsequent cultivation in milk produced the stormy fermentation characteristic of *B. welchii*. A small quantity of the culture was inoculated into three groups of guinea-pigs which had previously been injected with antisera to *B. welchii*, *Vibrion Septique* and *B. oedematiens* respectively, as well as into normal guinea-pigs. All the inoculated animals died of typical gas gangrene with the exception of those which had previously received an injection of *B. welchii* antiserum. From these experiments it is clear that *B. welchii* was commonly present in the air of the stable.

Six samples of dust from the interior of the roof of a second stable and six samples of material from crevices of the floor were collected in separate sterile vessels, and portions of each were inoculated into meat tubes which were incubated under anaerobic conditions, at 37° C. from 18 to 24 hours. The presence of *B. welchii* in every tube was established by the method already described.

Similarly this organism was proved to be present in the dust obtained in seven different buildings in which small laboratory animals (guinea-pigs and rabbits) were housed.

Since *B. welchii* apparently was constantly present in animal habitations it was decided to ascertain the distance that this organism might be carried, in the infected dust.

The experiment was performed as follows:

The direction of the prevailing wind was ascertained by means of thistle-down liberated from the top of a pair of steps about 7 feet from the ground.

Petri dishes containing nutrient broth were then placed at six points at distances of 30 feet and 90 feet radiating from the steps and in the direction of the wind current.

Some stable dust was then blown from the top of the steps by means of ordinary hand bellows.

The presence of *B. welchii* was established in each of the plates, except that on the extreme right at 90 feet, by cultural methods and animal experiments. Owing to lack of space the limits of dissemination of contaminated dust could not be ascertained.

#### SUMMARY.

From the foregoing experiments, it may be assumed:

(1) That given favourable conditions, such as a direct current of air through a building, organisms derived from animals, their fodder or environment, may be disseminated over distances up to 150 feet from the building.

(2) That *B. welchii* is frequently present in the dust and dirt of buildings in which horses and small laboratory animals (guinea-pigs and rabbits) are housed, and

(3) That under suitable conditions, spore-bearing anaerobes such as *B. welchii*, may be carried with infected dust from such buildings, for a distance of at least 90 feet, and probably considerably further.