

## ***Salmonella bovis-morbificans* (Basenau) from an outbreak of food-poisoning in the Cape Province.**

By

- M. W. HENNING, Department of Veterinary Science, University  
of Pretoria, and Onderstepoort Laboratories, and  
E. C. GREENFIELD, Department of Bacteriology, University of  
Capetown.

*Salmonella bovis-morbificans* was first isolated by Basenau (1893) in Amsterdam from the carcass of a cow that was emergency slaughtered after she had aborted and developed metritis. As the meat was condemned no cases of food-poisoning occurred, but Basenau regarded the organisms isolated very similar to those obtained from another animal, the meat of which had been responsible for an extensive outbreak of gastro-enteritis. On comparing this organism with *S. enteritidis* (Gaertner) and other bacteria obtained from outbreaks of food-poisoning he concluded that it differed from them both culturally and in pathogenicity. Cultures of Basenau's bacillus were kept by a number of workers and were studied by Savage (1908, 1912), Bruce White (1926, 1929) and others. Savage regarded it as a distinct sub-type of the Gaertner group, while Bruce White carefully worked out its antigenic structure.

No other strain of *bovis-morbificans* was recognised until Sladden and Scott (1927) isolated one from faeces studied during an outbreak of food-poisoning in Swansea, pressed meat being incriminated as the cause of the disease. The organism was recovered from the faeces of four of the affected persons and the sera of two patients agglutinated it. Later Kauffmann (1930) included two strains of *Salmonella*, Zeiss and Clauberg, into the new type *Virchow* just described by him, but, on making a closer study of the Zeiss and Clauberg strains, Kauffmann and Mitsui (1930) showed that they belonged to the *bovis-morbificans* type.

Recently Greenfield and Judd (1936) described an outbreak of food-poisoning in four members of the same family, incriminating boiled pork as the cause of the malady. Cultures made from the pork yielded a large number of colonies composed of "non-lactose-fermenting, motile, Gram-negative bacilli, which, by virtue of their

cultural characters, were placed in the *Salmonella* group of organisms" and called *Salmonella Suipestifer* var. *Afri. Aust.* The sera obtained from two of the patients caused a granular agglutination of the organism. A description of the biochemical characters and pathogenicity of the bacterium was given, but a complete antigenic analysis was not undertaken. The study of the antigenic structure of the *Salmonella* is now described by us.

*Suipestifer Afri. Aust.* was tested against both " O " and " H " sera prepared from a number of representative types of *Salmonella*; the sera were prepared according to the method described by Henning (1936). It was agglutinated only by the " O " sera of organisms containing factors VI and VIII of the Kauffmann-White schema (1934), by all group sera and by the type sera of *Heidelberg* and *bovis-morbificans*.

The organism was found to be diphasic. A culture was plated and after 24 hours incubation a number of colonies was picked and seeded into broth; after 5 hours incubation at 37° C. the broth cultures were tested against a pure group serum, e.g. *Kunzendorf* serum, and the type sera of *Heidelberg* and *bovis-morbificans*. The colonies that occurred in the group phase agglutinated only with *Kunzendorf* serum, while those that occurred in the type phase were flocculated by *Heidelberg* and *bovis-morbificans* sera. Group, type and " O " suspensions were now prepared according to the method described by Lovell (1932); these were tested against a number of sera. The results are shown in Table I. It will be seen that *Heidelberg* serum agglutinated the type and group antigens, but not the " O " antigen, that *Kunzendorf* serum flocculated only the group antigen, while *bovis-morbificans* agglutinated all three antigens up to a very high titre. Meanwhile sera were also prepared against *Suipestifer* var. *Afri. Aust.*

On absorbing *Afri. Aust.* serum with *Heidelberg* all agglutinins for the type phases of both *Heidelberg* and *Afri. Aust.* were exhausted, but there was hardly any reduction of the group agglutinins (from 6400-3200) and all the " O " agglutinins remained. (Table I). When this partly absorbed serum was reabsorbed with *Kunzendorf* a further reduction of group agglutinins (from 3200-400) occurred, but the " O " agglutinins remained unaltered—*Kunzendorf* apparently did not lower the " O " titre of the serum for the " O " antigen of *Afri. Aust.*; it also has no effect on the type agglutinins but it reduced the titre of the group agglutinins for the homologous group antigen from 6400 to 400. On the other hand, *Afri. Aust.* removed all the type and very little of the group agglutinins from *Heidelberg* serum without altering the " O " titre for the homologous " O " antigen. *Afri. Aust.* also exhausted most of the group agglutinins (lowering it from 3200 to 200) from *Kunzendorf* serum without reducing its " O " titre.

On absorbing *bovis-morbificans* serum with *Afri. Aust.* and *Afri. Aust.* serum with *bovis-morbificans* all agglutinins for the type, group and " O " antigens of both *bovis-morbificans* and *Afri. Aust.* were completely removed. (Table I).

It is not clear why *Afri. Aust.* could not exhaust all the group agglutinins from *Kunzendorf* serum or why *Kunzendorf* failed to remove all group agglutinins from *Afri. Aust.* serum, because the group antigen of *Afri. Aust.* is similar to that of *bovis-morbificans* and the group antigens of *bovis-morbificans* and *Kunzendorf* are identical, Bruce White (1926) and the Kauffmann-White schema (1934).

It was also observed that there is barely any "O" agglutination between *Afri. Aust.* and *Kunzendorf*, indicating that the somatic factor VI is not well represented in *Afri. Aust.*; but the same was found to be the case with *Newport* (*Kottbus*), *S. muenchen* and *S. bovis-morbificans* (Sladden and Scott), (Table I).

#### CONCLUSIONS.

These results clearly show that *S. suipestifer* var. *Afri. Aust.* contains the same type antigen as *Heidelberg* and *bovis-morbificans* (factor *r*) and a group antigen that corresponds largely with that of *Kunzendorf* and entirely with that of *bovis-morbificans* (factors 1, 3, 4, 5), while its somatic "O" antigen resembles that of *bovis-morbificans* (factors VI, VIII). Moreover, since *Afri. Aust.* removes all agglutinins (type, group and "O") from *bovis-morbificans* serum, and *bovis-morbificans* exhausts all agglutinins from *Afri. Aust.* serum there can be no doubt that the two organisms contain the same antigenic components and that they are, therefore, identical.

Greenfield and Judd (vidé Addendum to this paper) agree with us that the name *Salmonella suipestifer* var. *Afri. Aust.* employed in describing the *Salmonella* isolated by them (1936) from pork which was responsible for an outbreak of food poisoning in the Cape Peninsula should be discarded. The organism should be called *Salmonella bovis-morbificans*.

This is apparently the first strain of *bovis-morbificans* traced to pork and it is the first record of this organism in South Africa.

#### SUMMARY.

The antigenic structure of the *Salmonella* isolated by Greenfield and Judd (1936) from an outbreak of food-poisoning at the Cape Peninsula is described. As its antigenic components were found to resemble those of *bovis-morbificans* the following antigenic factors should be assigned to it:—

- Somatic "O" antigen, VI, VIII.
- "H" (Specific) antigen, *r*
- "H" (non-specific) antigen, 1, 3, 4, 5,

The reason why *Kunzendorf* failed to absorb all the group agglutinins from this strain of *bovis-morbificans* and vice versa is still obscure.

ADDENDUM.

E. C. Greenfield and M. H. Judd (Department of Bacteriology, University of Capetown), Professor Henning's antigen, i.e. analysis of a *Salmonella suipestifer* described by us from an outbreak of food poisoning in the Cape Peninsula makes it clear that the organism is *Salmonella bovis-morbificans*. Therefore, we withdraw the name *Salmonella suipestifer* var. *Afri. Aust.* and substitute *Salmonella bovis-morbificans*.

REFERENCES.

- BASENAU, F. (1893). Ueber eine Fleisch gefundene infectioese Bacteria. *Arch. f. Hyg.*, Vol. 20, p. 242. Quoted by Sladden and Scott, and by Bruce White.
- GREENFIELD, E. C., AND JUDD, M. H. (1936). *Salmonella suipestifer* var. *Afri. Aust.* in an Outbreak of Food Poisoning in the Cape Peninsula. *S.A. Medical Journal*, Vol. 10, No. 15, p. 544.
- HENNING, M. W. (1936). *Salmonella onderstepoort*: A New Type of *Salmonella* from a Sheep. *Jl. Hyg.*, Vol. 36, pp. 625-531.
- KAUFFMANN, F., U. MITSUI, CH. (1930). Vergleichende Untersuchungen. *Z. f. Hyg.*, Vol. 111, pp. 749-772.
- KAUFFMANN, F. (1930). Neue Serologische Typen der Paratyphusgruppe. *Z. f. Hyg.*, Vol. 111, pp. 221-246.
- KAUFFMANN-WHITE SCHEMA of the Salmonella Subcommittee of the Nomenclature Committee of the International Society for Microbiology. *Jl. of Hyg.*, Vol. 34, pp. 333-350 (1934).
- LOVELL, R. (1932). The *Salmonella* Group of Bacteria. *Bull. of Hyg.*, Vol. 7, pp. 405-415.
- SAVAGE, W. G. (1909). Further Report upon the Presence of the Gaertner Group of Organisms in the Animal Intestine. *37th Report of the Local Gov. Board* (1907-08), pp. 425-444. H.M. Stationery Office.
- SAVAGE, W. G. (1912). A Note on the Inter-classification of the Gaertner Group. *J. of Hyg.*, Vol. 12, pp. 1-4.
- SLADDEN, A. F., AND SCOTT, W. M. (1927). Food-poisoning due to Bacilli of the type *B. morbificans-bovis* (Basenau). *Jl. of Hyg.*, Vol. 26, pp. 111-117.
- WHITE, P. BRUCE (1926). Further Studies of the *Salmonella* Group. *Sp. Series No. 103, Med. Res. Council*, pp. 124-126.
- WHITE, P. BRUCE (1929). *A System of Bacteriology*, Vol. 4, *Med. Res. Council*, pp. 86-153.

TABLE I.

Antigen.	Unabsorbed Sera.					Absorbed Sera.								
	Afri. Aust. serum unabsorbed.	Heidelberg serum unabsorbed.	Kunzensdorf serum unabsorbed.	Neurport Kottbus serum.	Muenchen serum.	Bovis-morbificans serum unabsorbed.	Afri. Aust. serum absorbed with Kunzensdorf.	Afri. Aust. serum absorbed with Heidelberg.	Afri. Aust. serum absorbed with Bovis-morbificans.	Kunzensdorf serum absorbed with Afri. Aust.	Heidelberg serum absorbed with Afri. Aust.	Bovis-morbificans serum absorbed with Afri. Aust.	Bovis-morbificans serum absorbed with Bovis-morbificans.	Afri. Aust. serum absorbed by Heidelberg and then by Kunzensdorf.
Afri. Aust. "O" .....	800	0	0	1600	800	1600	400	800	0	—	—	0	0	400
Afri. Aust. Type.....	6400	6400	0	—	—	6400	6400	0	—	—	—	0	0	0
Afri. Aust. Group.....	6400	3200	3200	—	—	25600	400	3200	0	—	—	0	0	400
Heidelberg "O" .....	0	800	—	—	—	—	—	—	—	800	—	—	—	—
Heidelberg Type.....	6400	6400	—	—	—	—	—	0	—	—	—	—	—	—
Heidelberg Group.....	1600	12800	800	—	—	—	—	0	—	6400	—	—	—	—
Kunzensdorf "O" .....	50	—	800	—	—	—	—	—	—	—	—	—	—	—
Kunzensdorf "H" .....	3200	—	3200	—	—	—	0	—	—	—	800	—	—	—
Bovis-morbificans "O" .....	800	—	0	—	—	1600	—	—	0	—	—	0	0	—
Bovis-morbificans Type.....	3200	—	—	—	—	6400	—	—	0	—	—	0	0	—
Bovis-morbificans Group.....	6400	—	—	—	—	25600	—	—	0	—	—	0	0	—
Neurport (Kottbus) "O" .....	—	—	0	1600	—	—	—	—	—	—	—	—	—	—
Muenchen "O" .....	—	—	0	—	800	—	—	—	—	—	—	—	—	—

0 = less than 1:50.