

**The geographical distribution of
Salmonella typhi and *Salmonella paratyphi* A and B phage
types during the period 1 January 1966 to 31 December 1969**

A Report of the
INTERNATIONAL COMMITTEE FOR ENTERIC
PHAGE-TYPING (ICEPT)

(Received 26 June 1972)

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This report has been compiled by the Secretary, Dr P. Nicolle, from the material provided by the Directors of National Centres and of some Regional Centres of the ICEPT. It was delivered at the meeting of the ICEPT during the 10th International Congress of Microbiology on 8 August 1970 in Mexico. The English version was prepared and edited by the Chairman, Dr E. S. Anderson.*

* Thanks are due to Dr J. F. Vieu of the Institut Pasteur, Paris, for assistance with the original French text, and to Mrs P. L. M. Hutchinson for secretarial assistance with the English version. Requests for reprints should be addressed to Dr P. Nicolle, Institut Pasteur, 25 Rue du Dr Roux, 750 15-Paris, or to Dr E. S. Anderson, Enteric Reference Laboratory, Central Public Health Laboratory, Colindale Avenue, London NW9 5HT.

The results are given in alphabetical order for each of the five continents, and for the countries within the continents.

EXPLANATION OF TABLES

For the purpose of comparison, the presentation of the type distribution proposed by the Secretary for previous reports has been adopted. The percentages of phage types in each country are presented in order of frequency, and the resulting lists comprise one, two or three parts as necessary. The first part (*a*) includes the most numerous phage types, that is, those whose total percentage reaches about 90. In the second part (*b*) are the less common types whose individual percentages are still over 0.5. Finally, when the total number of strains is high enough, the third part (*c*) indicates phage types which are very rare in the area concerned, and whose individual percentages are less than 0.5. This method of presentation has the advantage of indicating the distribution of phage types according to their numerical importance.

Type designations

Recognized Vi-phage types have either lettered or numerical designations. For example, E1; F1; 40.

I+IV indicates cultures resistant to all the specific typing adaptations of Vi-phage II of Craigie & Yen (1938*a, b*) but sensitive to phages I and/or IV of Craigie & Yen.

Degraded Vi-strains. These cross-react widely with the Vi-typing phages, but do not conform to a specific typing pattern.

Vi-negative. Cultures devoid of Vi antigen, which cannot be typed with Vi-phages. The name of each Director is given under the individual centres.

All figures in parentheses are percentages.

ALGERIA

DR F. PAPA – Algiers

(1) *Salmonella typhi*

Type distribution by cases: 387

(*a*) A (39.6); E1a (14.25); B2 (12.9); degraded Vi-strains (9.84); 34 (7.86); C1 (3.8); 42 (2.84); Vi-negative (2.84); 38 (2.07); D1 (1.55); I+IV (1.03); F1 (0.78); 46 (0.52); C4 (0.26).

(2) *Salmonella paratyphi A*

Type distribution by cases: 14.

1: 13 strains. 4: 1 strain.

(3) *Salmonella paratyphi B*

Type distribution by cases: 27.

B.A.O.R.: 7 strains. Dundee: 7 strains. Beccles: 5 strains. Taunton: 4 strains. Untypable: 3 strains. 3a: 1 strain.

SOUTH AFRICA (Republic of)

MISS C. G. CROCKER - Pretoria

(1) *Salmonella typhi*

Type distribution by cases: 8585.

(a) A (71·17); I + IV (10·84); E1 (6·20).

(b) Degraded Vi-strains (5·35); Vi-negative (3·24); D1 (1·14).

(c) 40 (0·33); F1 (0·32); 28 (0·30); T (0·18); 29 (0·17); B1 (0·16); D4 (0·14); D7 (0·10); O (0·09); L2 (0·06); G1 (0·02); 46 (0·02); C1 (0·01); C8 (0·01); D6 (0·01); D8 (0·01); E2 (0·01); 45 (0·01).

Type distribution by foci: 5747

(a) A (72·64); I + IV (10·59); Degraded Vi-strains (6·34).

(b) E1 (4·06); Vi-negative (3·67); D1 (0·82).

(c) 28 (0·45); 40 (0·44); F1 (0·29); D4 (0·12); B1 (0·11); D7 (0·1); 46 (0·04); G1 (0·03); L2 (0·03); O (0·03); 29 (0·03); C1 (0·02); C8 (0·02); D6 (0·02); D8 (0·02); T (0·02); 45 (0·02); E2 (0·01).

BRAZIL

DR GOBERT A. COSTA - Rio-de-Janeiro

(1) *Salmonella typhi*

Number of strains examined: 181.

Two main foci and 9 isolated cases.

Type distribution:

(a) A (39·22); E1 (30·93); Vi-positive non-sensitive strains (I + IV group) (7·73); T (7·17); F1 (5·50).

(b) Degraded Vi-strains (4·97); G (2·20); D1 (0·55); F2 (0·55); 28 (0·55); 38 (0·55).

CANADA

DR W. C. HARRIS - Ottawa

(1) *Salmonella typhi*

Type distribution by cases: 199.

(a) E1 (22·5); degraded Vi-strains (10·5); A (9·5); I + VI (8·0); F1 (7·5); C1 (6·5); D1 (5·0); D9 (4·0); 46 (3·5); N + D1 (3·5); M1 (3·0); E4 (2·5); N (2·0); O (2·0).

(b) B1 (1·5); C4 (1·5); Vi-negative (1·5); B2 (1·0); 35 (1·0); C2 (0·5); D2 (0·5); E7 (0·5); F4 (0·5); L1 (0·5); 28 (0·5); 45 (0·5).

Type distribution by foci: 166.

(a) E1 (22·3); degraded Vi-strains (10·8); A (9·0); I + IV (9·0); C1 (5·4); D1 (5·4); F1 (5·4); N + D1 (4·2); D9 (3·6); M1 (3·6); 46 (3·6); E4 (2·4); B1 (1·8); O (1·8); Vi-negative (1·8).

(b) B2 (1·2); C4 (1·2); N (1·2); 35 (1·2); C2 (0·6); D2 (0·6); E7 (0·6); F4 (0·6); L1 (0·6); 28 (0·6); 45 (0·6).

(2) *Salmonella paratyphi B*

Type distribution by cases: 302.

(a) Untypable (26·5); 3a1 var. 1 (14·6); 3a (12·2); Worksop (10·6); Battersea (7·3); Beccles (4·3); 1 (4·0); 3a1 (4·0); Taunton (3·3); 1 var. 3 (3·0); 3a var. 4 (3·0).

(b) 3b (2·6); 1 var. 2 (1·0); 3b var. 2 (0·7); 3b var. 3 (0·7); atypical (0·7).

(c) B.A.O.R. (0·3); Dundee (0·3); Dundee var. 1 (0·3); 50 (0·3).

Type distribution by foci: 197.

(a) Untypable (29·4); Worksop (11·7); 3a (11·2); Battersea (9·1); 3a1 var. 1 (7·1); 1 (6·1); 3a1 (4·6); Beccles 4·1; Taunton (3·5); 3a var. 4 (3·0); 3b (3·0).

(b) 1 var. 3 (2·0); atypical (1·0); 1 var. 2 (0·5); 3b var. 2 (0·5); 3b var. 3 (0·5); B.A.O.R. (0·5); Dundee (0·5); Dundee var. 1 (0·5); 50 (0·5).

DR S. S. KASATIYA – Montreal

(1) *Salmonella typhi*

Type distribution by cases: 159.

(a) Degraded Vi-strains (16·2); E1 (14·3); A (12·8); I+IV (12·0); F1 (10·3); Vi-negative (8·6); C1 (8·0); E4 (5·8); D1 (3·6).

(b) B2 (3·2); B1 (2·7); F2 (1·0); F3 (0·6); 46 (0·6).

(2) *Salmonella paratyphi B*

Type distribution by cases: 37.

(a) 3a (50·0); Worksop (19·0); 3a1 (13·0); Taunton (13·0).

(b) 3b (3·7).

UNITED STATES OF AMERICA

MISS V. WILSON – Atlanta

(1) *Salmonella typhi*

Type distribution by foci: 626.

(a) E1 (23·80); degraded Vi-strains (18·37); C1 (12·46); A (6·54); F1 (4·63); D1 (4·47); I+IV (4·31); Vi-negative (3·67); 46 (3·03); B1 (2·55); D7 (1·75); B2 (1·60); J1 (1·27); N (1·11); M1 (0·95).

(b) D9 (0·79); 38 (0·79); C4 (0·63); E9 (0·63); 35 (0·63).

(c) B3 (0·47); C9 (0·47); D6 (0·47); D8 (0·47); F4 (0·47); T (0·47); C3 (0·31); E2 (0·31); 26 (0·31); 28 (0·31); 40 (0·31); 50 (0·31); D2 (0·15); D Group (0·15); E3 (0·15); G1 (0·15); 25 (0·15); 27 (0·15); 49 (0·15).

WEST INDIES – JAMAICA

DR L. S. GRANT – Mona-Kingston

(1) *Salmonella typhi*

Type distribution by cases: 107.

(a) E1 (54·62); 45 (19·50); Vi-negative (9·90); A (7·37).

(b) C4 (5·52); degraded Vi-strains (2·40).

Type distribution by foci: 86.

(a) E1 (52·00); 45 (20·0); Vi-negative (12·80); C4 (6·20)

(b) A (4·70); degraded Vi-strains (4·0).

INDIA

DR A. K. THOMAS - Kasauli

(1) *Salmonella typhi*

Type distribution by cases: 330.

(a) A (64·50); E1 (21·12); E4 (5·80).

(b) I+IV (2·77); degraded Vi-strains (2·62); K1 (1·50); O (0·72); B2 (0·62).

(c) E9 (0·32).

(2) *Salmonella paratyphi* A

Type distribution by cases: 43

(a) 1 (38·05); 2 (35·82); 3 (14·32).

(b) 6 (10·87); untypable (0·92).

DR S. L. BHATIA - New Delhi

(1) *Salmonella typhi*

Type distribution by cases: 3,944.

(a) A (67·69); E1 (15·16); O (9·12); K (2·76); D6 (2·63); J (0·65); Vi-negative (0·60); D1 (0·50); M1 (0·43); 28 (0·23); F1 (0·10); G1 (0·02); T (0·02).

(2) *Salmonella paratyphi* A

Type distribution by cases.

(a) 2 (50·34); 1 (42·12).

(b) 6 (6·16); untypable (1·02).

(c) 5 (0·34).

JAPAN

DR H. FUKUMI - Tokyo

(1) *Salmonella typhi*

Type distribution by cases: 1284.

(a) D2 (25·3); degraded Vi-strains (12·1); H (11·4); E1 (10·4); M1 (10·3); D1 (6·7); E4 (4·6); Vi-negative (3·8); B2 (2·5); E11 (2·4); 39 (2·4).

(b) I+IV (2·0); D6 (1·9); A (1·2); 46 (0·8).

(c) C5 (0·4); B1 (0·2); B8 (0·2); E7 (0·1); L1 (0·1); M3 (0·1); N (0·1); O (0·1); 25 (0·1); 41 (0·1).

Type distribution by foci: 853.

(a) D2 (26·5); degraded Vi-strains (14·4); M1 (12·0); E1 (10·7); D1 (6·7); Vi-negative (6·7); E4 (4·2); I+IV (3·6); B2 (2·9); H (2·8).

(b) D6 (2·5); A (1·9); E11 (1·3); 39 (1·8); 46 (1·2); C5 (0·5).

(c) B1 (0·4); D8 (0·2); E7 (0·1); L1 (0·1); M3 (0·1); N (0·1); O (0·1); 25 (0·1); 41 (0·1).

(2) *Salmonella paratyphi* B

Type distribution by cases: 145.

(a) 3a (43·4); 1 (24·8); untypable (15·9); 3a1 (4·1).

(b) Beccles (2·8); Taunton (2·8); Dundee (2·8); 3b (1·4); B.A.O.R. (1·4); 2 (0·7).

Type distribution by foci: 141.

(a) 3a (44·0); 1 (24·8); untypable (15·6); 3a1 (4·3).

(b) Beccles (2·8); Dundee (2·8); Taunton (2·1); 3b (1·4); B.A.O.R. (1·4); 2 (0·7).

(3) *Salmonella paratyphi A*

Type distribution by cases: 83.

(a) 4 (68·7); untypable (20·5).

(b) 1 (8·4); 2 (1·2); 3 (1·2).

Type distribution by foci: 79.

(a) 4 (67·1); untypable (22·75).

(b) 1 (8·9); 2 (1·3); 3 (1·3).

AUSTRALIA

MISS J. TAPLIN – Melbourne

(1) *Salmonella typhi*

Type distribution by cases: 175.

(a) E1 (33·7); D1 (10·7); A (9·4); I+IV (9·0); F1 (8·7); C1 (8·3); degraded Vi-strains (7·7); C4 (2·5).

(b) J1 (1·7); M1 (1·4); 40 (1·0); N (0·9); C2 (0·7); D6 (0·7); E9 (0·7); 38 (0·7); 46 (0·7); O (0·6); D4 (0·51).

(c) 35 (0·3).

Type distribution by foci: 104.

(a) E1 (31·4); A (13·6); degraded Vi-strains (10·9); D1 (8·4); I+IV (7·5); C1 (6·9); F1 (5·2); C4 (1·8); D4 (1·7); M1 (1·7).

(b) O (1·7); 40 (1·7); J1 (1·6); D6 (0·9); E9 (0·9); 46 (0·9); C2 (0·8); N (0·8); 35 (0·8); 38 (0·8).

(2) *Salmonella paratyphi B*

Type distribution by human cultures: four cultures, all type Taunton.

Type distribution in water samples or sewage.

Taunton: 22 strains. 1: 8 strains. 1 var. 6: 1 strain. 1 var. 1: 1 strain. 3a: 1 strain. 3a1 var. 1: 1 strain.

POLYNESIA

TONGA (Friendly Islands)

153 strains isolated from 1967 to 1969.

E1 (83·1); A (14·3); I+IV (1·9); degraded Vi-strains (0·7).

AUSTRIA

DR W. ROSCHKA – Graz

(1) *Salmonella typhi*

Type distribution by cases: 226.

(a) A (27·43); D (22·56); E (17·69); Group I+IV (10·61); F (8·84); degraded Vi-strains (4·42).

(b) B (3·09); C (3·09); N (1·32).

(c) T (0·44); 28 (0·44).

(2) *Salmonella paratyphi* B

Number of strains examined from all origins: 1509.

Type distribution:

(a) Taunton (36·24); Dundee (36·18); 1 (9·21); B.A.O.R. (4·17); degraded strains (2·91); 3a (2·31).

(b) 3b var. 3 (1·78); 3a var. 2 (1·52); 3a1 (1·45); 3b var. 2 (0·86); Beccles (0·86); 3a1 var. 1 (0·59); 3a1 var. 2 (0·53); 3b (0·53).

(c) Jersey (0·33); 1 var. 1 (0·19); 1 var. 2 (0·19); Workstop (0·06).

BELGIUM

PROF. J. BEUMER – Brussels

(1) *Salmonella typhi*

Type distribution by cases: 83.

(a) C1 (31·3); E1 (24·1); A (12·0); D1 (6·0); 46 (6·0); degraded Vi-strains (3·6).

(b) C5 (2·4); D4 (2·4); D9 (2·4); 28 (2·4); I + IV (2·4); Vi-negative (2·4); F1 (1·2); 40 (1·2).

Type distribution by foci: 75.

(a) C1 (32·0); E1 (20·0); A (13·3); D1 (6·7); 46 (6·7); degraded Vi-strains (4·0).

(b) D4 (2·7); D9 (2·7); 28 (2·7); I + IV (2·7); Vi-negative (2·7); C5 (1·3); F1 (1·3); 40 (1·3).

(2) *Salmonella paratyphi* B

Type distribution by cases: 37.

(a) 3a1 (32·4); Dundee (29·7); Jersey (21·6); 1 (8·1).

(b) Untypable (5·4); 3a (2·7).

Type distribution by foci: 36.

(a) 3a1 (30·6); Dundee (30·6); Jersey (22·2); 1 (8·3).

(b) Untypable (5·5); 3a (2·8).

BULGARIA

DR ROSA COHEN – Sofia

(1) *Salmonella typhi*

Type distribution by cases: 128.

(a) E1 (25·00); A (17·18); I + IV (16·40); F1 (15·62); Vi-negative (15·62).

(b) D1 (7·81); degraded Vi-strains (1·56); 40 (0·78).

Type distribution by foci: 114.

(a) E1 (21·05); A (19·29); F1 (16·66); I + IV (16·66); Vi-negative (15·78).

(b) D1 (7·89); degraded Vi-strains (1·75); 40 (0·87).

CZECHOSLOVAKIA

DR J. BORECKA – Bratislava

(1) *Salmonella typhi*

Type distribution by cases: 2050.

D1 (25·50); E1 (21·42); A (13·94); F1 (8·57); degraded Vi-strains (7·63); C1 (6·75); I + IV (3·56); 46 (2·83); D9 (2·76); Vi-negative (1·82); D6 (1·60); D4 (1·02);

28 (0·87); C4 (0·36); 40 (0·36); D2 (0·30); F5 (0·22); B2 (0·14); 27 (0·14); 32 (0·14); C5 (0·07).

Type distribution by foci: 1007.

E1 (22·64); D1 (21·94); A (13·90); F1 (8·94); degraded Vi-strains (8·84); C1 (5·86); I+IV (4·47); 46 (2·98); Vi-negative (2·48); D9 (1·69); D6 (1·59); D4 (1·29); 28 (1·09); C4 (0·50); 40 (0·49); D2 (0·40); F5 (0·30); B2 (0·20); 27 (0·20); C5 (0·10); 32 (0·10).

(2) *Salmonella paratyphi B*

Type distribution by cases: 503.

Taunton (33·11); Beccles (19·82); untypable (13·51); 1 var. (7·66); 1 (6·75); 3a1 (3·60); 3a (3·15); B.A.O.R. (2·93); Dundee (2·93); 3a1 var. (2·70); 3a var. ? (2·03); 3b (0·90); 3b var. ? (0·43); Beccles var. ? (0·23); Dundee var. ? (0·23).

Type distribution by foci: 374.

Taunton (38·50); untypable (16·04); 1 var. ? (9·09); 1 (8·02); Beccles (5·61); 3a1 (4·28); 3a (3·74); B.A.O.R. (3·48); Dundee (3·48); 3a1 var. ? (3·21); 3 var. ? (2·40); 3b (1·07); 3b var. ? (0·54); Beccles var. ? (0·27); Dundee var. ? (0·27).

FINLAND

DR P. H. MAKELA – Helsinki

(1) *Salmonella typhi*

Type distribution by cases: 34.

(a) B2 (38·23); C4 (23·52); D1 (11·76); A (5·88); 50 (5·88); Vi-negative (5·88).

(b) E1 (2·94); F1 (2·94); 40 (1·94).

Type distribution by foci: 15

D1 (26·66); A (13·33); 50 (13·33); Vi-negative (13·33); C4 (6·66); D2 (6·66); E1 (6·66); F1 (6·66); 40 (6·66).

(2) *Salmonella paratyphi B*

Type distribution by cases: 407.

(a) Taunton (64·5); 3a1 var. 1 (20·2); N.S.T. (7·4).

(b) 3a var. 4 (1·7); untypable (1·5); 3a (1·00); 1 (0·7); 3b (0·7); Beccles (0·7).

(c) 1 var. 5 (0·2); 3a1 (0·2); Battersea (0·2); Beccles (var. 3) (0·2); Jersey (0·2);

Worksop (0·2).

Type distribution by foci: 290.

(a) Taunton (60·00); 3a1 var. 1 (22·0); N.S.T. (9·0).

(b) 3a var. 4 (2·1); untypable (2·1); Beccles (1·0); 1 (0·7); 3b (0·7).

(c) 1 var. 5 (0·3); 3a (0·3); 3a1 (0·3); Battersea (0·3); Beccles var. 3 (0·3); Jersey (0·3); Worksop (0·3).

FRENCH CENTRE

DR P. NICOLLE, from 1966 to 1968 (inclusive)

DR J.-F. VIEU in 1969

(I) FRANCE

(1) *Salmonella typhi*

Type distribution by cases: 1024.

(a) E1 (25.78); A (16.59); C1 (15.23); degraded Vi-strains (12.20); D1 (6.45); F1 (4.50); B2 (4.20); Vi-negative (2.93); 46 (2.64);

(b) C4 (1.37); D4 (1.27); 42 (1.30); C5 (0.87); L2 (0.59); I + IV (0.59).

(c) Central African variety of phage-type C1 (0.49); T (0.48); 34 (0.39); D2 (0.30); F5 (0.30); G1 (0.30); C3 (0.29); N (0.19); 29 (0.20); C2 (0.09); D6 (0.09); E3 (0.09); F4 (0.09); J1 (0.09); 41 (0.09).

(2) *Salmonella paratyphi B*

Type distribution by cases: 772.

(a) Dundee (35.49); Taunton (19.56); 1 (16.97); Jersey (8.94); 3a1 (5.57); untypable (5.18).

(b) Beccles (4.54); 3b (1.95); 3a (0.76); B.A.O.R. (0.64).

(c) Battersea (0.39).

(3) *Salmonella paratyphi A*

Total numbers of strains: 291.

France: 23 cultures; phage-types 1, 2 and 4.

Algeria: 24 cultures; phage-types 1, 2 and 4.

Morocco: 68 cultures; phage-types 1 and 2.

Senegal: 2 strains; phage-type 1.

Egypt: 115 cultures; phage-types 1 (29.56); 2 (46.95); and 4 (16.52); untypable (6.96).

Iran: 1 strain; phage-type 6.

Syria: 1 strain; phage-type 2.

Israel: 26 strains; phage-types 1, 2 and 4.

Cambodia: 7 strains; phage-type 1 and untypable group.

Vietnam: 1 strain; phage-type 1.

Turkey: 23 strains; phage-types 1 and 2 (the strains of phage-type 2 represent 95.65% of the cultures considered).

(II) NORTH AFRICA*

Morocco (strains sent to the French Centre for Enteric Phage-typing by the Institut Pasteur of Casablanca and of Tangiers).

(1) *Salmonella typhi*

Type distribution by cases: 485.

(a) C1 (53.61); A (15.88); E1 (9.69); degraded Vi-strains (6.60); D1 (4.75).

* The strains of *S. para A* isolated in these different countries are included in paragraph 3 of section I of the French report.

- (b) 42 (2·68); Vi-negative (2·06); B2 (1·86); C5 (0·83); D4 (0·62).
 (c) E2 (0·42); L2 (0·42); D2 (0·21); O (0·21); 40 (0·21).

(2) *Salmonella paratyphi B*

Number of cases considered: 9

Type distribution.

Taunton: 5 strains. 3a1: 2 strains. Beccles: 2 strains.

Algeria (see the report of Dr F. Papa of the Institut Pasteur of Algeria).

*Tunisia** (strains sent to the French Centre for Enteric Phage-typing, by the Institut Pasteur of Tunis).

Salmonella typhi

Type distribution by cases: 267.

(a) E1 (58·43); A (25·84); 42 (5·99).

(b) degraded Vi-strains (4·50); Vi-negative (3·37); O (1·12).

(c) D6 (0·38); 34 (0·38).

*Egypt** (strains sent to the French Centre by Namru-3-Cairo).

(1) *Salmonella typhi*

Type distribution by cases 225.

(a) Degraded Vi-strains (23·56); 40 (17·78); C1 (10·22); D1 (8·44); I + IV (7·11); Vi-negative (6·67); A (6·22); E1 (4·89); 42 (4·0); J1 (2·67).

(b) E2 (2·22); G1 (1·78); T (1·33); C5 (0·88).

(c) F3 (0·44); L2 (0·44); O (0·44); 36 (0·44); 50 (0·44).

(2) *Salmonella paratyphi B*

Type distribution of 5 strains: Taunton (3 strains); Dundee (2 strains).

(III) FRENCH-SPEAKING BLACK AFRICA*

Senegal (strains received from the Institut Pasteur of Dakar).

Salmonella typhi:

Type distribution by cases: 269.

(a) A (46·47); E1 (24·91); Vi-negative (10·41); C4 (6·32); degraded Vi-strains (3·72).

(b) D1 (3·35).

Ivory Coast (strains received from the Institut Pasteur of Abidjan).

Salmonella typhi

Type distribution by cases: 214.

(a) A (42·51); C1 (19·15); degraded Vi-strains (14·02); Vi-negative (11·22); D1 (5·14).

(b) E1 (3·73); 42 (2·80).

(c) C2 (0·46); C4 (0·46); D6 (0·46); 29 (0·46).

*Upper Volta** (strains received from the Institut Pasteur of Ouaga Dougou).

Salmonella typhi

Type distribution by cases: 89.

(a) A (76·40); E1 (10·11); Degraded Vi-strains (4·49).

(b) C1 (3·37); D6 (2·24); Vi-negative (2·24); 42 (1·12).

*Republic of Chad and Central African Republic**

Salmonella typhi

Type distribution by cases: 38.

(a) Central African variety of phage-type C1 (78·94); Vi-negative (10·52).

(b) A (7·89); E1 (2·63).

*Cameroon** (strains received from the Institut Pasteur of Yaounde).

Salmonella typhi

Type distribution by cases: 133.

(a) A (79·70); C1 (9·77).

(b) Vi-negative (5·26); D1 (1·50); C4 (0·75); F1 (0·75); 34 (0·75); 35 (0·75); degraded Vi-strains (0·75).

Congo Zaïre and Congo Brazzaville (strains received from Dr Van Oye of the Institut Pasteur of Brazzaville).

Salmonella typhi

Type distribution by cases: 124.

(a) A (35·48); E1 (31·45); Central African variety of phage-type C1 (12·90); degraded Vi-strains (11·29).

(b) O (5·64); Vi-negative (1·61); B2 (1·24); I + IV (1·24).

Madagascar (Malagasy Republic) (strains received from the Institut Pasteur of Tananarive).

Salmonella typhi

Type distribution by cases: 18.

(a) E1 (53·76); A (38·17).

(b) Vi-negative (3·76); degraded Vi-strains (2·69); C1 (1·61).

(IV) MIDDLE EAST

Turkey (strains received from colleagues in Istanbul & Ankara).

Salmonella typhi

Type distribution by number of strains: 7.

T: 3 strains. 28: 2 strains. B2: 1 strain. 46: 1 strain.

Iran (Strains received from the Institut Pasteur of Teheran).

Salmonella typhi

Type distribution by cases: 49.

(a) Degraded Vi-strains (44·89); I + IV (18·36); F1 (10·20); A (8·16); 28 (6·12).

(b) D1 (2·04); D6 (2·04); M1 (2·04); 39 (2·04); 40 (2·04); Vi-negative (2·04).

(V) FAR EAST

South Vietnam and Cambodia (strains sent by the Institut Pasteur of Saigon and the Institute of Biology of Phnom-Penh).

Salmonella typhi

Type distribution by cases: 611.

(a) I+IV (40·91); degraded Vi-strains (9·32); E1 (7·36); A (6·54); Vi-negative (6·54); D2 (4·90); 37 (3·76); M1 (3·36); D2 (2·45); D6 (1·96); E10 (1·96); 29 (1·47).

(b) D1 (0·98); G1 (0·98); M2 (0·64); M4 (0·64); 28 (0·64).

(c) D4 (0·48); E7 (0·48); F1 (0·48); J3 (0·48); 46 (0·32); 49 (0·32); C1 (0·16); C5 (0·16); E2 (0·16); E3 (0·16); E9 (0·16); J1 (0·16); L1 (0·16); M3 (0·16); 25 (0·16); 38 (0·16); 39 (0·16).

(VI) AMERICA: CARRIBEAN REGION

Dutch Guyana; French West Indies (Islands of Martinique and Guadeloupe).

Salmonella typhi

(Ninety-three strains sent by the Institut Pasteur of Cayenne, of Fort-de-France, of Pointe-a-pitre and by colleagues from Dutch Guyana)

Type distribution by cases:

(a) A (73·11); E1a (10·75); N (8·60)

(b) Degraded Vi-strains (5·37); C1 (2·15).

(VII) AUSTRALASIA

New Caledonia

Salmonella typhi (6 strains received from the Institut Pasteur of Noumea).

A: 4 strains. D2: 2 strains.

French Polynesia: Tahiti

Salmonella typhi (29 strains received from the Institut Pasteur of Papeete).

E1a: 15 strains. A: 13 strains. Vi-negative: 1 strain.

GERMANY (FEDERAL REPUBLIC OF)

DR I. BOHLCK – Kiel

(1) *Salmonella typhi*

(A) Number of strains examined, isolated from diseased persons or carriers: 119.

Type distribution by cases:

(a) E1a (19·30); F1 (16·03); A (15·20); I+IV group (8·40); degraded Vi-strains (7·50); Vi-negative (7·50); E1b (5·90); D1 (5·00); D2 (3·40); 28 (3·40).

(b) 46 (3·40); C1 (1·70); N (1·70); D6 (0·80); T (0·80).

(B) Type distribution by foci: 109.

(a) E1a (18·30); F1 (17·40); A (13·70); I+IV group (8·30); degraded Vi-strains (8·30); Vi-negative (8·30); D1 (5·50); E1b (5·50); D2 (3·70); 46 (3·70).

(b) 28 (2·80); N (1·80); C1 (0·90); D6 (0·90); T (0·90).

(2) *Salmonella paratyphi B*

(A) Number of strains examined, isolated from diseased persons or carriers: 119.

Type distribution by cases:

(a) Taunton-Kampen (42·00); 3a1 var. 2 (12·60); 1 (11·80); untypable (10·1); 3a1 (7·60); 3a1 var. 1 (5·00); 3b (2·50).

(b) B.A.O.R. (2·50); 3a (1·70); Beccles (1·70); Dundee (1·70); 3b var. 1 (0·80).

(B) Type distribution by foci: 99.

(a) Taunton-Kampen (34·40); 1 (13·20); untypable (12·10); 3a1 var. 2 (11·10); 3a1 (9·10); 3a1 var. 1 (6·1); 3b (3·0).

(b) B.A.O.R. (3·0); 3a (2·0); Beccles (2·0); Dundee (2·0); 3b var. 1 (1·00).

PROF. DR. H. BRANDIS - Bonn

(1) *Salmonella typhi*

(A) Number of strains examined, isolated from diseased persons or carriers: 1092.

Type distribution by cases:

(a) E1a (21·79); A (13·92); degraded Vi-strains (11·09); F1 (8·42); C1 (6·68); Vi-negative (6·41); D1 (5·49); E1b (5·31); D2 (3·39); 46 (2·93); untypable II (2·93); untypable I (1·94).

(b) 38 (1·37); N (1·10); 28 (1·10); F4 (0·82); F5 (0·82); D9 (0·73); D4 (0·64).

(c) C4 (0·46); D6 (0·37); T (0·27); 40 (0·27); rough (0·27); B2 (0·18); J1 (0·18); B1 (0·09); E2 (0·09); E7 (0·09); E10 (0·09); 27 (0·09).

(B) Type distribution by foci: 950.

(a) E1a (22·42); A (14·63); degraded Vi-strains (11·68); F1 (8·11); Vi-negative (6·42); C1 (6·32); D1 (5·68); E1b (5·16); D2 (3·26); 46 (2·95); untypable II (2·95); untypable I (2·00).

(b) 28 (1·37); F4 (0·95); N (0·84); D4 (0·74); D9 (0·74); F5 (0·74); 38 (0·53).

(c) C4 (0·42); D6 (0·42); 40 (0·32); Rough (0·32); D2 (0·21); T (0·21); B1 (0·11); E2 (0·11); E7 (0·11); E10 (0·11); J1 (0·11); 27 (0·11).

(2) *Salmonella paratyphi B*

(A) Number of strains examined, isolated from diseased persons or carriers: 891.

Type distribution by cases:

(a) Taunton (28·06); B.A.O.R. (18·41); 1 (12·46); 3a1 (6·40); untypable (6·06); Dundee (5·16); 3a (4·94); 3a1 var. 1 (4·71); 3b (4·38).

(b) Beccles (3·70); Rough (2·99); 3a var. 4 (1·01); Jersey (1·01); 3a1 var. 4 (0·56).

(c) 1 var. 8 (0·11); 3a var. 2 (0·11).

(B) Type distribution by foci: 670.

(a) Taunton (30·00); B.A.O.R. (14·18); 1 (13·58); 3a1 (6·87); untypable (6·27); 3a (5·67); 3b (5·08); Dundee (4·63); 3a1 var. 1 (3·73).

(b) Rough (3·28); Beccles (3·13); 3a var. 4 (1·34); Jersey (1·19); 3a1 var. 4 (0·75).

(c) 1 var. 8 (0·15); 3a var. 2 (0·15).

DR V. LENK – Berlin

(1) *Salmonella typhi*

Type distribution by cases: 249.

(a) E1a (19·28); A (15·26); degraded Vi-strains (10·04); F1 (8·03); I + IV (8·03); Vi-negative (7·23); D2 (6·02); D1 (5·22); F5 (5·22); C1 (4·02); E1b (2·81).

(b) 46 (1·61); D4 (1·20); 28 (1·20); 40 (1·20); T (0·80).

(c) B2 (0·40); C4 (0·40); D9 (0·40); F4 (0·40); J1 (0·40); 50 (0·40); Rough (0·40).

Type distribution by foci: 205.

(a) E1a (19·51); A (16·10); degraded Vi-strains (10·73); F1 (9·27); Vi-negative (8·29); I + IV (7·80); D1 (5·85); C1 (4·39); D2 (4·39); E1b (2·44); 46 (1·95).

(b) 28 (1·46); 40 (1·46); D4 (0·98); F5 (0·98); T (0·98).

(c) B2 (0·49); C4 (0·49); D9 (0·49); F4 (0·49); J1 (0·49); 50 (0·49); Rough (0·49).

(2) *Salmonella paratyphi B*

Type distribution by cases: 214.

(a) Taunton (34·64); B.A.O.R. (18·69); 3a1 (9·81); 1 (8·88); 3a1 var. (5·61); 3b (5·61); Rough (4·21); untypable (3·74).

(b) 3a (2·80); Jersey (2·34); Dundee (2·34); Beccles (1·40).

(c) 1 var. (0·47); 3b var.? (0·47).

Type distribution by foci: 201.

(a) Taunton (32·84); B.A.O.R. (18·41); 3a1 (9·45); 1 (8·96); 3a1 var. (5·97); 3b (5·97); Rough (4·48); untypable (3·98).

(b) 3a (2·99); Jersey (2·49); Dundee (1·99); Beccles (1·49); 1 var. ? (0·50); 3b var. ? (0·50).

DR V. LENK AND DR B. SCHMIDT – Berlin

(1) *Salmonella typhi*

Type distribution by cases: 658.

(a) E1a (19·15); I + IV (12·61); degraded Vi-strains (11·85); Vi-negative (10·49); A (10·33); F1 (9·88); D2 (5·78); D1 (4·56); E1b (4·56).

(b) C1 (2·89); 40 (2·89); 28 (1·52); 46 (0·76); rough (0·61).

(c) F4 (0·46); F5 (0·46); J1 (0·30); Vi-positive phage-negative (0·30); C4 (0·15); M1 (0·15); 32 (0·15); 38 (0·15).

Type distribution by foci: 634.

(a) E1a (19·24); I + IV (12·93); degraded Vi-strains (11·67); Vi-negative (10·88); A (10·25); F1 (9·94); D2 (5·84); E1b (4·73); D1 (4·57).

(b) C1 (3·0); 40 (2·05); 28 (1·26); 46 (0·79); rough (0·63).

(c) F4 (0·47); F5 (0·47); J1 (0·32); Vi-positive phage-negative (0·32); C4 (0·16); M1 (0·16); 32 (0·16); 38 (0·16).

(2) *Salmonella paratyphi* B

Type distribution by cases: 274.

(a) Taunton (31·75); 3a1 (14·23); 1 (13·14); B.A.O.R. (10·22); 3a (9·12); rough (8·39); 3a1 var. (5·11).

(b) Untypable (2·92); Dundee (1·82); 3b (1·09); Jersey (1·09); Beccles (0·73).

(c) 3b var. (0·36).

Type distribution by foci: 256.

(a) Taunton (33·59); 3a1 (13·28); 1 (12·89); B.A.O.R. (9·38); 3a (8·59); rough (8·59); 3a1 var. ? (5·08).

(b) Untypable (3·13); Dundee (1·95); 3b (1·17); Beccles (0·78).

(c) 3b var. ? (0·39).

DR POLANETZKI – Frankfurt-on-Main

(1) *Salmonella typhi*

Type distribution by cases: 1173.

(a) E1a (14·64); A (11·66); F5 (9·88); degraded Vi-strains (8·43); D1 (6·56); E1b (6·56); F1 (6·56); C1 (5·71); Vi-negative (5·45); untypable I (5·11); 46 (3·49); untypable II (2·81); D2 (2·56).

(b) 28 (2·22); D9 (1·88); 40 (0·85); D6 (0·77); F2 (0·76); J1 (0·59); C4 (0·52); E7 (0·52).

(c) D4 (0·43); D8 (0·43); B2 (0·34); E10 (0·34); 38 (0·34); N (0·26); D10 (0·17); F4 (0·08); T (0·08).

Type distribution by foci: 896.

(a) E1a (17·63); A (12·80); Degraded Vi-strains (9·82); F1 (7·81); C1 (7·24); D1 (7·13); Vi-negative (6·66); E1b (6·47); untypable I (5·91); 46 (3·34); untypable II (3·34); D2 (3·11); 28 (1·89).

(b) D6 (1·00); 40 (1·00); F2 (0·89).

(c) E7 (0·44); E10 (0·44); J1 (0·44); B2 (0·33); C4 (0·33); D4 (0·33); N (0·33); 38 (0·33); D8 (0·22); D9 (0·22); F5 (0·22); D10 (0·11); F4 (0·11); T (0·11).

(2) *Salmonella paratyphi* B

Type distribution by cases: 955.

(a) Taunton (34·56); 3a1 var. 1–2 (11·62); B.A.O.R. (10·16); 1 (8·27); untypable (6·91); 3a1 (6·59); Dundee (5·76); Beccles (4·71).

(b) 3a (4·09); 3b (3·25); 1 var. 2 (2·19); 3a Jersey ? (0·73); Jersey (0·52).

(c) 3a var. 4 (0·32); 2 (0·21); 3b var. 2 (0·11).

Type distribution by foci: 777.

(a) Taunton (33·97); 3a1 var. 1–2 (11·32); B.A.O.R. (9·40); 1 (8·49); untypable (7·10); 3a1 (7·07); Dundee (5·40); Beccles (4·89).

(b) 3a (4·24); 3b (3·86); 1 var. 1 (2·32); 3a Jersey ? (0·77); Jersey (0·64).

(c) 3a var. 4 (0·24); 2 (0·13); 3b var. 2 (0·13).

DR F. WURSCHING – Munich

(1) *Salmonella typhi*

Type distribution by cases: 549.

A (19.3); E1a (16.2); atypical (14.0); D1 (10.9); F1 (10.2); untypable (5.8); C1 (4.9); Vi-negative (2.9); B2 (2.7); C2 (1.4); E1b (1.4); F5 (1.1); E10 (0.9); 38 (0.9); D2 (0.7); D4 (0.7); D6 (0.7); 28 (0.7); C4 (0.6); T (0.6); 40 (0.6); F4 (0.4); 34 (0.4); 46 (0.4); C5 (0.2); D9 (0.2); E2 (0.2); 27 (0.2); 35 (0.2); 36 (0.2); 42 (0.2); N (0.2).

Type distribution by foci: 449.

A (19.6); E1a (15.2); atypical (14.9); D1 (10.3); F1 (8.3); untypable (6.7); C1 (5.6); Vi-negative (3.1); B2 (2.7); E1b (1.8); C2 (1.3); F5 (1.1); 38 (1.1); D4 (0.9); 28 (0.9); C4 (0.7); D2 (0.7); D6 (0.7); E10 (0.7); T (0.7); 34 (0.4); 40 (0.4); 46 (0.4); C5 (0.2); D9 (0.2); E2 (0.2); F4 (0.2); 27 (0.2); 35 (0.2); 36 (0.2); 42 (0.2); N (0.2).

(2) *Salmonella paratyphi B*

Type distribution by cases: 405.

Taunton–Kampen (40.1); 1 (10.0); 3a1 var. 2 (9.1); B.A.O.R. (8.6); 3b var. 5 (3.2); rough (3.00); 1 (2.2); 1 var. 1 (2.2); 3a1 Leeuwarden (2.2); B.T.6 (2.2); atypical (2.2); Taunton–Kampen var. 1 (2.00); 3a (1.7); untypable (1.7); Jersey (1.5); Dundee (1.0); 3a var. 2 (1.0); Q3 (1.0); 3a var. 6 (0.8); 3a var. 4 (0.8); Beccles 22 (0.5); Midwoud (0.5); S1–54 (0.5); B.T.3 (0.5); 3b (0.2); 3b var. 2 (0.2); 3a1 Schiedam (0.2); P3 (0.2); Q6 (0.2).

Type distribution by foci: 298.

Taunton–Kampen (35.7); 1 (10.1); B.A.O.R. (8.40); 3a1 var.1–2 (8.1); 3b var. 5 (4.0); rough (3.7); B.T.6 (3.0); 1 var. 1 (2.7); 1 (2.3); 3a (2.3); 3a1 Leeuwarden (2.3); atypical (2.3); untypable (2.3); Taunton–Kampen var. 1 (2.0); Jersey (1.7); Dundee (1.6); 3a var. 2 (1.0); 3a var. 4 (1.0); Beccles 22 (0.7); Midwoud (0.7); B.T.3 (0.7); 3b (0.3); 3b var. 2 (0.3); S1–54 (0.3); Sittard (0.3); 3a1 Schiedam (0.3); P3 (0.3); Q3 (0.3); Q6 (0.3).

GERMANY (DEMOCRATIC REPUBLIC OF)

DR H. RISCHE – Wernigerode/Harz

(1) *Salmonella typhi*

Type distribution by cases: 4087.

E1a (21.3); A (9.5); degraded Vi-strains (9.0); Vi-negative (8.6); I+IV (8.1); F1 (7.8); E1b (7.0); D1 (5.9); C1 (5.7); D2 (3.3); F4 (2.6); 46 (2.1); N (1.8); 38 (1.1); T (0.9); 28 (0.9); 40 (0.9); D4 (0.7); D6 (0.4); D9 (0.4); F5 (0.4); F2 (0.3); F7 (0.2); C5 (0.1); E7 (0.1); B2 (0.08); C4 (0.05); D7 (0.05); J4 (0.05); 29 (0.05); 34 (0.05); 36 (0.05); 50 (0.05); B3 (0.02); J1 (0.02); M1 (0.02); 43 (0.02).

Type distribution by foci: 3227.

E1a (20.7); A (9.5); degraded Vi-strains (9.3); Vi-negative (8.5); I+VI (8.4); F1 (7.9); E1b (7.1); D1 (6.3); C1 (5.8); D2 (3.5); F4 (2.6); 46 (2.0); 38 (1.1); D4 (0.9); T (0.9); 28 (0.9); N (0.8); 40 (0.8); F5 (0.5); D6 (0.4); D9 (0.4); F2 (0.3);

F7 (0·2); E7 (0·1); C4 (0·06); C5 (0·06); D7 (0·06); J4 (0·06); 29 (0·06); 34 (0·06); 36 (0·06); B2 (0·03); B3 (0·03); J1 (0·03); M1 (0·03); 43 (0·03); 50 (0·03).

(2) *Salmonella paratyphi B*

Type distribution by cases: 2269.

Taunton (41·5); 3a1 (15·9); 1 (14·1); B.A.O.R. (7·5); 3b (6·1); untypable (5·7); 3a (5·6); Dundee (2·00); Beccles (0·5); Jersey (0·4).

Type distribution by foci: 1667.

Taunton (41·7); 3a1 (16·9); 1 (14·4); B.A.O.R. (7·3); untypable (6·5); 3a (5·5); 3b (4·2); Dundee (2·1); Beccles (0·6); Jersey (0·4).

HUNGARY

DR H. MILCH – Budapest

(1) *Salmonella typhi*

Type distribution by cases: 6062.

(a) E1a (21·20); A (19·91); D1 (19·25); F1 (9·54); degraded Vi-strains (8·60); C1 (6·50); I+IV (3·70); B2 (3·45).

(b) Vi-negative (2·65); D2 (0·90); E1b (0·90); 28 (0·82).

(c) D4 (0·49); 46 (0·49); C2 (0·32); B1 (0·24); B3 (0·16); D9 (0·16); F5 (0·16); 27 (0·16); C4 (0·08); D6 (0·08); E4 (0·08); 38 (0·08); 43 (0·08).

Type distribution by foci: 714.

(a) A (19·60); E1a (18·58); D1 (17·02); F1 (10·08); degraded Vi-strains (9·24); C1 (6·58); B2 (4·48); I+IV (4·20).

(b) Vi-negative (3·22); D2 (1·12); E1b (1·12); 28 (0·84); D4 (0·70); 46 (0·70); C2 (0·56).

(c) B1 (0·42); B3 (0·28); D9 (0·28); F5 (0·28); 27 (0·28); C4 (0·14); D6 (0·14); E4 (0·14); 38 (0·14); 43 (0·14).

(2) *Salmonella paratyphi B*

Type distribution by cases: 821.

(a) Taunton (58·65); 1 (8·84); untypable (6·50); 3a1 var. 2 (5·36); B.A.O.R. (5·36); Dundee (4·59).

(b) 1 var. 1 (2·68); 3a1 (2·68); Beccles (1·91); 3a1 var. 1 (1·53); 3a (0·76).

(c) 3b (0·38); 3b var. 2 (0·38); 3b var. 3 (0·38).

Type distribution by foci: 161.

(a) Taunton (48·44); 1 (11·80); 3a1 var. 2 (8·07); B.A.O.R. (7·48); Dundee (6·85); untypable (6·84).

(b) 3a1 (2·48); Beccles (2·48); 1 var. 1 (1·86); 3a (1·24); 3a1 var. 1 (0·62); 3b (0·62); 3b var. 2 (0·62); 3b var. 3 (0·62).

ITALY (Southern)

THE LATE PROFESSOR G. D'ALESSANDRO – Palermo

(1) *Salmonella typhi*

Type distribution by cases: 182.

(a) C1 (40·6); degraded Vi-strains (18·1); A (12·0); C4 (6·5); D1 (6·5); Vi-negative (4·3); C3 (2·7).

(b) E1 (2·1); 46 (1·6); I+IV (1·6); B2 (1·0); E10 (0·5); F5 (0·5); 28 (0·5); 37 (0·5).

Type distribution by foci: 156.

(a) C1 (42·3); A (14·1); degraded Vi-strains (12·1); C4 (7·6); D1 (7·6); C3 (3·2); E1 (2·5).

(b) Vi-negative (2·5); 46 (1·9); I+IV (1·9); B2 (1·2); E10 (0·6); F5 (0·6); 28 (0·6); 37 (0·6).

(2) *Salmonella paratyphi B*

Type distribution by cases: 66.

(a) Untypable (63·6); atypical (9·00); 3a1 var. 3 (7·5); B.A.O.R. (6·0); Dundee (6·0).

(b) 3a1 var. 1 (3·00); 3a1 (1·5); Taunton (1·5).

Type distribution by foci: 46.

(a) Untypable (54·3); atypical (13·0); 3a1 var. 3 (10·8); Dundee (8·6); 3a1 var. 1 (4·3).

(b) 3a1 (2·1); B.A.O.R. (3·1); Taunton (2·1).

ITALY (Northern)

PROFESSOR A. GIOVANARDI – Milan

(1) *Salmonella typhi*

Type distribution by cases: 261.

A (25·67); I+IV (23·75); degraded Vi-strains (13·79); E1 (9·19); C1 (8·82); D1 (8·82); Vi-negative (7·66); D4 (0·77); F1 (0·77); B2 (0·38); N (0·38).

Type distribution by foci: 249.

A (26·90); I+IV (24·89); degraded Vi-strains (14·46); C1 (9·23); Vi-negative (8·04); D1 (7·22); E1 (6·82); D4 (0·81); F1 (0·81); B2 (0·41); N (0·41).

(2) *Salmonella paratyphi B*

Type distribution by cases: 38.

Taunton (44·73); untypable (18·43); B.A.O.R. (13·16); 1 var. 5 (7·90); 1 var. 8 (2·63); 3a1 (2·63); 3b var. 3 (2·63); 3b var. 6 (2·63); Beccles (2·63); Dundee var. 1 (2·63).

Type distribution by foci: 28.

Taunton (35·72); untypable (35·72); 1 var. 5 (3·57); 1 var. 8 (3·57); 3a1 (3·57); 3b var. 3 (3·57); 3b var. 6 (3·57); Beccles (3·57); B.A.O.R. (3·57); Dundee var. 1 (3·57).

ITALY (Central)

DR D. PARVIS – Pisa

(1) *Salmonella typhi*

Type distribution by cases: 79.

(a) A (24·50); C1 (22·02); D1 (18·86); Vi-negative (16·52); E1 (6·45).

(b) I + IV (5·95); B2 (1·90); degraded Vi-strains (1·90); 46 (1·04); F1 (0·86).

Type distribution by foci: 52.

(a) A (24·48); C1 (20·30); D1 (19·87); Vi-negative (13·46); E1 (7·12); I + IV (5·65).

(b) B2 (3·03); degraded Vi-strains (3·03); 46 (1·56); F1 (1·47).

(2) *Salmonella paratyphi B*

Type distribution by cases: 52.

(a) Taunton (25·89); 3a1 (21·67); 1 (16·05); untypable (14·60); Dundee (6·67); 2 (6·66).

(b) B.A.O.R. (5·88); 3b (1·66); Beccles (1·47).

Type distribution by foci: 39.

(a) Taunton (32·13); 3a1 (25·29); untypable (13·38); 1 (9·81); Dundee (8·03).

(b) 2 (5·35); Beccles (2·08); B.A.O.R. (2·08); 3b (1·78).

NETHERLANDS

National Centre of Utrecht (unsigned report)

(1) *Salmonella typhi*

Number of strains examined: 180.

It is not specified whether the results are given by cases or by foci.

Type distribution:

(a) E1 (26·66); A (19·44); D1 (13·88); C1 (12·22); 46 (7·22); D2 (5·0); D6 (3·33); F1 (2·22); 28 (1·66).

(b) B3 (1·11); D7 (1·11); D 8 (1·11); C9 (0·55); D4 (0·55); D8 (0·55); G1 (0·55); O (0·55); 27 (0·55); 9 (0·55); 35 (0·55); 40 (0·55).

(2) *Salmonella paratyphi B*

Number of strains examined: 215.

(a) Taunton–Kampen (34·41); 1 of F and C (14·88); 3a1 Leewarden (7·88); Jersey (7·88); atypical strains (5·58); 3a1 var. 1–2 (4·65); Dundee (4·65); 3a (4·18); 3a1 Schiedam (3·72); Midwoud (3·25).

(b) 3b (1·86); Sittard (1·86); Beccles–Meppel (1·39); B.A.O.R. (0·93); Q1 (0·93).

(c) 3a var. 1 (0·46); B.T.6 (0·46); Q7 (0·47); P3 (0·46).

NORWAY

DR R. SAXHOLM – Oslo

(1) *Salmonella typhi*

Type distribution by cases: 13.

A: 4 cases. F1: 3. E1: 2. D1: 1. J1: 1. I + IV: 1. Degraded Vi-strains: 1.

(2) *Salmonella paratyphi B*

Type distribution by cases: 21.

1: 9 cases and three foci. Taunton: 4. 3a: 2. 3a1: 2. Untypable: 2. Dundee: 1.

POLAND

PROF. DR Z. BUCZOWSKI – Gdansk

(1) *Salmonella typhi*

Type distribution by cases: 9325.

(a) E1a (21·51); F1 (13·33); A (11·34); degraded Vi-strains (11·0); D1 (7·60); Vi-negative (6·87); C1 (5·98); I + IV (4·42); E1b (4·35); 46 (2·85); 28 (1·51).

(b) F4 (1·46); D4 (1·20); 40 (1·07); F5 (0·86); D2 (0·77); D9 (0·72); N (0·70); D6 (0·68).

(c) D7 (0·30); J1 (0·27); 38 (0·17); B2 (0·16); E7 (0·15); F3 (0·15); E10 (0·08); T (0·07); E3 (0·06); C5 (0·05); C4 (0·04); F7 (0·04); M1 (0·04); C2 (0·03); E4 (0·03); F2 (0·03); 43 (0·03); E9 (0·02); 36 (0·02); C3 (0·01); D5 (0·01); D8 (0·01); 50 (0·01).

Type distribution by foci: 7402.

(a) E1a (21·57); F1 (13·35); degraded Vi-strains (11·55); A (11·11); D1 (7·95); Vi-negative (7·50); I + IV (4·91); C1 (4·36); E1b (4·07); 46 (2·85).

(b) F4 (1·62); D4 (1·39); 40 (1·17); D9 (1·04); F5 (0·89); D6 (0·78); N (0·78); 28 (0·72); D2 (0·52).

(c) J1 (0·31); B2 (0·20); 38 (0·20); F3 (0·18); D7 (0·17); E7 (0·12); T (0·12); E10 (0·10); E3 (0·07); C4 (0·05); C5 (0·05); F7 (0·05); M1 (0·05); C2 (0·04); E4 (0·04); E9 (0·02); F2 (0·02); 36 (0·02); 43 (0·02); C3 (0·01); D5 (0·01); D8 (0·01); 50 (0·01).

(2) *Salmonella paratyphi A*

Type distribution by cases and by foci: 36.

(a) 1 (75·02); 4 (16·66).

(b) Untypable (5·55); 3 (2·77).

(3) *Salmonella paratyphi B*

Type distribution by cases: 1670.

(a) Taunton (35·07); 1 (20·08); B.A.O.R. (14·09); 3a1 var. 1–2 (9·16); 3a (5·98); 3a1 (4·85).

(b) Untypable (4·49); Dundee (1·79); Beccles (1·61); 3b (1·49); Jersey (1·01).

(c) 3b var. 1 (0·17); 3a var. 1 (0·11); 3a var. 2 (0·05); 3a var. 4 (0·05).

Type distribution by foci: 1332.

(a) Taunton (36·17); 1 (19·06); B.A.O.R. (11·48); 3a1 var. 1–2 (10·93); 3a1 (5·78); untypable (5·10).

(b) 3a (3·67); Beccles (2·10); Dundee (2·10); 3b (1·95); Jersey (1·12).

(c) 3b var. 1 (0·22); 3a var. 1 (0·15); 3a var. 2 (0·07); 3a var. 4 (0·07).

PORTUGAL

DR A. C. SAMPAIO – Lisbon

(1) *Salmonella typhi*

Type distribution by cases: 81.

(a) E1 (38·27); A (24·69); B3 (11·11); 46 (7·41); D1 (6·17).

(b) Degraded Vi-strains (6·17); I+IV (3·70); Vi-negative (2·47).

Type distribution by foci: 37.

(a) A (27·03); E1 (13·51); 46 (13·51); degraded Vi-strains (13·51); B3 (8·81); D1 (8·81).

(b) I+IV (5·41); Vi-negative (5·41).

(2) *Salmonella paratyphi B*

3 strains. 3a var. 4: 2 strains. Untypable: 1 strain.

ROMANIA

First PROF. N. NESTORESCO (now deceased) then

DR M. POPOVICI – Bucharest

(1) *Salmonella typhi*

Type distribution by cases: 2397.

(a) A (22·24); E1 (17·33); F1 (15·80); degraded Vi-strains (9·39); D9 (7·92); D1 (7·14); I+IV (7·12); Vi-negative (4·27).

(b) C1 (3·98); C4 (0·74); F5 (0·73); 38 (0·64); 46 (0·58).

(c) D6 (0·42); C2 (0·30); F3 (0·21); 48 (0·18); D4 (0·16); 40 (0·16); 28 (0·12); B2 (0·11); C5 (0·10); D2 (0·09); E10 (0·05); F4 (0·05); T (0·05); K1 (0·03); M1 (0·03); K2 (0·03).

Type distribution by foci: 1589.

(a) A (24·98); E1 (15·72); F1 (14·17); degraded Vi-strains (9·55); I+IV (7·42); D1 (6·84); D9 (6·75); Vi-negative (5·16).

(b) C1 (4·32); C4 (0·88); 38 (0·87); F5 (0·72); 46 (0·54).

(c) D6 (0·44); F3 (0·25); C2 (0·21); 40 (0·19); D2 (0·15); 28 (0·13); C5 (0·10); B2 (0·08); D4 (0·08); E10 (0·08); F4 (0·08); T (0·08); K1 (0·05); K2 (0·05); M1 (0·05); 48 (0·05).

(2) *Salmonella paratyphi B*

Type distribution by cases: 68, and by foci: 68.

(a) Atypical (23·52); untypable (16·17); Taunton (14·70); 1 (11·76); B.A.O.R. (10·29); 1 var. 4 (7·35); 3a1 (4·41); Dundee (4·41).

(b) 3a var. 4 (2·94); 3a var. 1 (1·47); 3a var. 6 (1·47); 3a var. 4 (1·47).

SPAIN

DR J. RUIZ MERINO – Madrid

(1) *Salmonella typhi*

Type distribution by cases: 44.

(a) E1 (29·54); A (20·45); D9 (20·45); 46 (6·81); D1 (4·54); T (4·54); I+IV (4·54).

(b) C1 (2·27); D5 (2·27); D6 (2·27); N (2·27).

Type distribution by foci: 30.

(a) E1 (43·33); A (13·33); D1 (6·66); T (6·66); 46 (6·66); I+IV (6·66).

(b) C1 (3·33); D5 (3·33); D6 (3·33); D9 (3·33); N (3·33).

(2) *Salmonella paratyphi B* (2 cases).

B.A.O.R. (2 cases, 2 foci).

SWEDEN

DR L. O. KALLINGS – Stockholm

(1) *Salmonella typhi*

Type distribution by cases: 54.

(a) E1 (24); A (15); F1 (13); C1 (11); 46 (9); degraded Vi-strains (9); E3 (4); NST (4).

(b) D1 (2); D6 (2); J1 (2); N (2); 32 (2).

Type distribution by foci: 52.

(a) E1 (25); A (15); C1 (12); F1 (10); 46 (10); degraded Vi-strains (10); E3 (4); NST (4).

(b) D1 (2); D6 (2); J1 (2); N (2); 32 (2).

(2) *Salmonella paratyphi B*

Type distribution by cases: 276.

Taunton (53); Dundee (11); 3a1 var. 4 (7); NST (5); 1 (4); 1 var. 2 (4); Beccles (3); NT (3); 1 var. 1 (1); 1 var. 6 (1); 1 var. 8 (1); 3a (1); 3a1 var. 1 (1); 3b (1); Jersey (1); B.A.O.R. (1); Dundee var. 1 (1); 1 var. 3 (< 1); 1 var. 4 (< 1); 3a var. 4 (< 1); 3a1 var. 2 ? (< 1); 3b var. 1 (< 1); 3b var. 6 (< 1); Taunton var. 1 (< 1).

Type distribution by foci: 210.

Taunton (50); Dundee (13); NST (7); 1 (4); 1 var. 2 (3); Beccles (3); NT (3); 3a1 var. 1 (2); B.A.O.R. (2); 1 var. 1 (1); 1 var. 6 (1); 3a (1); 3a1 (1); 3a1 var. 4 (1); 3b (1); Jersey (1); Dundee var. 1 (1); 1 var. 3 (< 1); 1 var. 4 (< 1); 1 var. 8 (< 1); 3a var. 4 (< 1); 3a1 var. 2 ? (< 1); 3b var. 1 (< 1); 3b var. 6 (< 1); Taunton var. 1 (< 1).

SWITZERLAND

PROFESSOR H. FEY – Berne

(1) *Salmonella typhi*

Type distribution by cases: 547.

(a) C1 (26·87); A and degraded A (23·94); E1 (12·43); B2 (5·85); untypable (5·85); D1 (5·30); C4 (4·57); N (3·47); 46 (2·55).

(b) C3 (1·46); D4 (1·46); group B (1·27); C2 (1·09); 38 (0·54).

(c) Group D (0·36); D2 (0·36); E4 (0·36); E7 (0·36); G1 (0·36); K2 (0·36); C5 (0·18); C7 (0·18); E3 (0·18); F4 (0·18); Vi-negative (0·18); F1 (0·18).

(2) *Salmonella paratyphi B*

Type distribution by cases: 339.

(a) Taunton (30·67); untypable (20·35); 1 var. 4 (8·25); Dundee (5·84); B.A.O.R. (5·01); 1 (4·71); group 1 (3·83); 3a1 var. 1 (2·65); Beccles var. 3 (2·35); Beccles (2·06); 3a1 var. 4 (1·76); 3a1 (1·47).

(b) 2 (1·17); 3a (1·17); Taunton var. 1 (1·17); 3 (0·88); 1010 (0·88); 3a var. 2 (0·58); Beccles var. 2 (0·58); Jersey (0·58); Worksop (0·58).

(c) 1 var. 1 (0·29); 1 var. 2 (0·29); 1 var. 11 (0·29); 3a var. 4 (0·29); 3a var. 7 (0·29); 3b (0·29); 3b var. 1 (0·29); 3b var. ? (0·29); Beccles var. 1 (0·29); Beccles var. 5 (0·29); Beccles n.n.t (0·29).

UNITED KINGDOM

DR E. S. ANDERSON – London

(1) *Salmonella typhi*

Type distribution by cases (267) of U.K. origin.

(a) E1 (17·9); A (15·8); Degraded Vi-strains (14·4); C1 (11·5); O (9·4); 46 (8·6); I+IV (7·2); Vi-negative (4·4); D1 (3·4).

(b) K1 (1·8); F1 (1·4); B2 (0·8); D6 (0·5).

(c) D4 (0·4); D6 (0·4); F4 (0·4); N (0·4); 45 (0·4); B1 (0·3); D2 (0·3); 28 (0·3).

Type distribution by foci (158) of U.K. origin

(a) E1 (17·3); A (17·1); Degraded Vi-strains (12·00); C1 (9·8); 46 (8·1); I+IV (8·1); O (7·2); Vi-negative (5·9); D1 (3·2); K1 (2·9).

(b) F1 (2·5); D6 (0·8); D4 (0·6); D10 (0·6); F4 (0·6); N (0·6); 45 (0·6); B1 (0·5); B2 (0·5); D2 (0·5); 28 (0·5).

Type distribution by cases (422) of foreign origin.

(a) E1 (19·4); Degraded Vi-strains (14·1); I+IV (12·3); A (10·7); D1 (10·0); C1 (6·1); O (5·6); 46 (3·3); 45 (2·1); 40 (2·00); C4 (1·5); F1 (1·5); Vi-negative (1·2).

(b) D2 (1·1); 28 (1·1); C5 (1·0); G1 (1·0); N+D1 (0·8); 38 (0·8); K1 (0·7); N (0·5); T (0·5).

(c) C3 (0·3); D5 (0·3); D6 (0·3); 32 (0·3); 34 (0·3); B2 (0·2); F4 (0·2); D2 (0·2); G2 (0·2); 42 (0·2).

Type distribution by foci (223) of foreign origin.

(a) E1 (14·9); degraded Vi-strains (14·1); A (11·5); I+IV (9·2); D1 (8·3); C1 (5·9); 46 (5·0); O (4·4); 40 (2·8); Vi-negative (2·3); G1 (2·1); C4 (2·0); 28 (2·0); F1 (1·8); 38 (1·7); 45 (1·7).

(b) T (1·2); C5 (1·1); N+D1 (1·1); K1 (0·9); N (0·9); D2 (0·8); C3 (0·6); D6 (0·6); D5 (0·5); 32 (0·5); 34 (0·5).

(c) B2 (0·4); F4 (0·4); G2 (0·4); 42 (0·4).

(2) *Salmonella paratyphi B*

Type distribution by cases (484) of U.K. origin.

(a) 1 (23·1); Taunton (14·0); Battersea (11·0); 3a (9·7); untypable (7·9); Dundee (4·6); Dundee var. 1 (4·0); 1 var. 1 (3·2); Worksop (3·2); 3a1 var. 1 (2·3); Beccles (2·2); 1 var. 9 (1·9); B.A.O.R. (1·9); 3a var. 2 (1·5).

(b) 3b var. 3 (1·4); Scarborough (1·2); 1 var. 4 (1·0); Jersey (0·8); 1 var. 2 (0·6); 1 var. 3 (0·6); 50 (0·5).

(c) 2 (0·4); 3b (0·4); 2 var. 1 (0·3); 3a var. 6 (0·3); 3a1 (0·3); 3b var. 6 (0·3); Taunton var. 1 (0·3); untypable r.d.n.c. (0·3); Beccles var. 3 (0·2); Beccles var. 5 (0·2); Beccles var. 6 (0·2); Jersey var. 3 (0·2).

Type distribution by foci (259) of U.K. origin.

(a) 1 (23.9); Taunton (15.2); 3a (8.7); Dundee (8.2); untypable (6.2); Battersea (5.6); 1 var. 1 (4.8); Dundee var. 1 (4.8); Beccles (3.6); 3a1 var. 1 (2.3); 1 var. 4 (2.0); Worksop (1.8); 3a var. 2 (1.8); 50 (0.9); Jersey (0.9).

(b) 1 var. 2 (0.8); 1 var. 3 (0.8); 2 (0.8); 3b (0.8); untypable r.d.n.c. (0.8); 2 var. 1 (0.7); B.A.O.R. (0.7).

(c) 1 var. 9 (0.4); 3a var. 6 (0.4); 3a1 (0.4); 3b var. 3 (0.4); Beccles var. 5 (0.4); Jersey var. 3 (0.4); Scarborough (0.4); Taunton var. 1 (0.4); 3b var. 6 (0.3); Beccles var. 3 (0.3); Beccles var. 6 (0.3).

Type distribution by cases (195) of foreign origin.

(a) Taunton (45.0); Dundee (14.4); 1 (8.0); untypable (7.8); 3a var. 4 (4.0); Dundee var. 1 (3.2); 3a1 (2.7); 3a1 var. 1 (2.5); B.A.O.R. (2.4).

(b) Beccles var. 3 (1.9); Beccles (1.6); 3b var. 9 (1.5); Battersea (1.5); 1 var. 4 (1.0); Jersey var. 2 (0.8); Jersey (0.6); Taunton var. 1 (0.6); untypable r.d.n.c. (0.5).

Type distribution by foci (103) of foreign origin.

(a) Taunton (37.5); Dundee (12.8); untypable (9.8); Dundee var. 1 (5.8); 3a var. 4 (4.9); 3a1 var. 1 (4.3); 1 (4.0); B.A.O.R. (3.7); Beccles (3.4); 3a1 (2.8); Beccles var. 3 (2.8).

(b) 1 var. 4 (1.8); 3b var. 9 (1.2); Battersea (1.2); untypable r.d.n.c. (1.2); Jersey (1.1); Taunton var. 1 (1.1); Jersey var. 2 (0.6).

YUGOSLAVIA

DR P. TOMASIC, then DR A. Z. DRAGAS – Zagreb

(1) *Salmonella typhi*

Type distribution by cases: 1257.

(a) A (43.44); D1 (18.38); E1a (8.67); C1 (6.6); Vi-negative (6.04); F1 (5.96).

(b) Degraded Vi-strains (2.39); 28 (2.07); 46 (1.43); C5 (1.35); E10 (0.87); I+IV (0.8); C2 (0.64).

(c) D9 (0.40); B2 (0.24); F4 (0.16); B1 (0.08); C9 (0.08); D2 (0.08); E2 (0.08); J4 (0.08); N (0.08); 34 (0.08).

Type distribution by foci: 672.

(a) A (46.58); E1a (11.46); F1 (9.67); Vi-negative (8.78); C1 (6.55); D1 (5.35).

(b) Degraded Vi-strains (3.57); 46 (2.08); C5 (1.04); 28 (1.04); I+IV (0.89); E10 (0.74).

(c) C2 (0.45); B2 (0.30); D9 (0.30); B1 (0.15); C9 (0.15); D2 (0.15); D9 (0.15); E2 (0.15); F4 (0.15); J4 (0.15); N (0.15); 34 (0.15).

(2) *Salmonella paratyphi* B

Type distribution by cases: 201.

(a) Taunton (69.65); 3a (11.45); 1 (5.47); Jersey (3.48); Dundee (3.48).

(b) 3a1 (1.49); 3b (1.49); Beccles (1.49); untypable (1.00); 1 var. 3 (0.50); 1 var. 4 (0.50).

Type distribution by foci: 165.

(a) Taunton (65.45); 3a (11.52); 1 (6.66); Jersey (4.24); Dundee (4.24).

(b) 3a1 (1.82); 3b (1.82); Beccles (1.82); untypable (1.21); 1 var. 3 (0.61); 1 var. 4 (0.61).

DR NADA STOSIC – Belgrade

(1) *Salmonella typhi*

Type distribution by cases: 541.

(a) A (24.7); E1 (14.2); I + IV (12.2); D4 (11.8); D1 (9.2); 28 (7.9); degraded Vi-strains (5.3); F1 (4.8).

(b) C1 (2.7); T (2.2); Vi-negative (2.0); D6 (1.6).

(c) C4 (0.3); C5 (0.3); 25 (0.1).

(2) *Salmonella paratyphi* B

Type distribution by cases: 172.

(a) Taunton (80.4); 3a (9.8).

(b) Beccles (9.3).

(c) 3a1 (0.4).

DISCUSSION

A. As in previous reports (Anderson, 1961; Nicolle, 1961*a, b*) important differences have been noted in the distribution of Vi-phage types and untypable groups of *Salmonella typhi* during the period 1966–1969, depending on the geographical origins of the strains considered.

Unfortunately, while a large number of strains (several hundred, and sometimes several thousand) were studied in many countries of Europe, Africa (North and South) and America (U.S.A., Canada), in many parts of the world, in contrast, the number was not representative of the total incidence of *S. typhi*. Consequently, any comparison of the distribution of phage types suffers from a fundamental fault; the number of phage types and varieties identified by a particularly busy centre will be high, whereas in another country, where only a small proportion of strains of *S. typhi* are sent to the National Centre for Enteric Phage Typing, the number of phage types may appear to be much lower.

For the comparison to be valid, each country should examine an equivalent proportion of strains or foci; such was not the case.

B. In spite of these serious objections, as we have already pointed out in previous reports (Anderson, 1961; Nicolle, 1961*a, b*), the Vi-phage types of *S. typhi* can be divided into groups according to their geographical distribution.

(1) Cosmopolitan phage types, generally the commonest types in Europe: A, B2, C1, D1, E1, F1, N, T, 28, 46, etc., and the three groups of untypable strains: I + IV; degraded Vi-strains; Vi-negative.

(2) Phage types frequently found in North Africa (Morocco, Algeria, Tunisia, Egypt) but less common or even non-existent in other parts of the world: L1, L2, 40, 42, etc.

(3) Phage types common in Black Africa and rare, often non-existent, in Europe

and in most parts of the world: C2, C4, D6, Central African variety of type C1, etc.

(4) Phage types especially common in countries bordered by the Indian Ocean: G1, etc.

(5) Phage types common or present only in the Far East, and rare or non-existent in most other parts of the world: C3, C5, D2, D4, E2, E3, E4, E7, E9, E10, G3, G5, J3, J5, M2, M3, M4 and, above all, type 37 and some I+IV groups.

(6) Phage type M1, rare or non-existent in Europe and Africa but, in contrast, common in the Far East, in the countries of the West coast of the Pacific Ocean and also found in Australia.

(7) Phage types present almost exclusively in America, especially Latin America: 26, 35, 38, etc.

To sum up, despite all the intermingling of strains of the typhoid bacillus caused by population migrations, wars, invasions, etc., important differences in the geographical distribution of phage types are still evident. Some types are cosmopolitan or semi-cosmopolitan. Others appear more or less limited to one area or to a group of neighbouring areas. It seems that the typhoid bacillus, which was initially homogeneous, has diversified in various regions of the world, and as if certain varieties, carried out of their original habitat, have reached distant regions, while others have extended only to a limited degree from their original territory.

From the phage typing of *S. typhi* we can therefore learn about the present distribution of phage types in different parts of the world, the changing distribution of phage types which is taking place, and the causes of these variations.

The same conclusions, perhaps not quite so clearly defined, can be drawn from the phage-typing studies of *S. paratyphi B*.

REFERENCES

- ANDERSON, E. S. (1961). Report of the International Reference Laboratory for Enteric Phage-Typing, 1953-1958. *Annales de l'Institut Pasteur, Paris* **102**, 379-88.
- CRAIGIE, J. & YEN, C. H. (1938*a*). Demonstration of types of *B. typhosus* by means of preparations of type II Vi phage: principles and technique. *Canadian Public Health Journal* **29**, 448-63.
- CRAIGIE, J. & YEN, C. H. (1938*b*). Demonstration of types of *B. typhosus* by means of preparations of type II Vi phage: stability and epidemiological significance of V form types of *B. typhosus*. *Canadian Public Health Journal* **29**, 484-96.
- NICOLLE, P. (1961*a, b*). Rapport sur la distribution des lysotypes de *S. typhi* et de *S. paratyphi B* dans le monde d'après les résultats fournis par les centres nationaux membres du Comité International de Lysotypie Enterique a l'occasion du Congrès International de Microbiologie, Stockholm, 1958. *Annales de l'Institut Pasteur, Paris* **102**, (a) 389-409; (b) 580-95.