

**The geographical distribution of *Salmonella typhi* and
Salmonella paratyphi A and *B* phage types during the period
1 January 1970 to 31 December 1973**

A Report of the
**INTERNATIONAL FEDERATION FOR ENTERIC
PHAGE-TYPING (IFEPT)**

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SUMMARY

The frequency distribution is presented of the Vi-phage types of *Salmonella typhi* and of the phage types of *S. paratyphi A* and *S. paratyphi B*, examined by the National Centres represented in the IFEPT from 1970 to 1974. The most common

types encountered in this international study were A and E1 (= E1a), as has been previously observed. There was, however, a wide range of types, many of which are characteristic of particular geographical zones. The occurrence of such types out of their habitual context indicates their 'exotic' origin, providing a useful clue to their probable source.

Plasmid-mediated chloramphenicol resistance appeared in epidemic typhoid fever for the first time during this period. It occurred in Mexico, India, Vietnam and Thailand, and has assumed important proportions. All the plasmids concerned belonged to compatibility group H1. The study of this phenomenon continues, and the findings will appear in future reports.

INTRODUCTORY NOTES

This report has been compiled by the Secretary, Dr P. Nicolle and the Associate Secretary, Dr J. F. Vieu, from the material provided by the Directors of National Centres and some Regional Centres of the IFEPT. It was delivered at the meeting of the IFEPT during the 12th International Congress of Microbiology on 4 September 1978 in Munich. The English version was prepared and edited by the Chairman, Dr E. S. Anderson.* As in the previous Reports, the results are given in alphabetical order for each of the five continents, except for the countries which have sent their strains to the French Centre, from which the results are given after those of the French Centre.

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 given 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

* Thanks are due to Mrs Linda R. Ward for help with the text, and to Mr Janet C. Vaughan for secretarial assistance. Requests for reprints should be addressed to Dr P. Nicolle, Institut Pasteur (Société de Pathologie Exotique), 25 rue du Dr Roux 75724 Paris-Cedex 15 (France).

Vi-phage II of Craigie & Yen (1938) 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. (Vi⁻ strains).

The name of each Director is given under the individual Centres.

Percentages are given in parentheses.

AFRICA

ALGERIA

DR B. MERED – Algiers

Salmonella typhi

Type distribution by cases: 2039.

(a) A (43·94); E1 (17·01); Vi⁻ and DVS (11·18); 46 (5·98); D1 (5·93); B2 (5·00).

(b) C1 (3·48); 42 (2·20); NT (1·81); 51 (1·27); D1-N (0·63).

(c) N (0·49); L2 (0·39); F1 (0·34); 53 (0·24); 40 (0·01).

EGYPT

DR R. A. HABLAS AND DR D. C. EDMAN – Cairo

(1) *Salmonella typhi*

Type distribution by cases: 221.

(a) C1 (18·55); I+IV (15·84); D1 (14·03); DVS (11·76); A (9·05); 40 (6·79); Vi⁻ (6·33); 46 (4·52); D8 (3·17); E1 (2·26); C10 (1·81); J1 (1·36).

(b) E2 (0·91); G1 (0·91); L2 (0·91).

(c) D11 (0·45); F3 (0·45); J4 (0·45); N (0·45).

(2) *Salmonella paratyphi A*

Type distribution by cases: 224.

(a) 1 (62·95); 2 (23·66); 4 (4·46).

(b) Untypable strains (8·93).

SOUTH AFRICA

Pretoria – DR C. G. CROCKER AND R. MARITZ – Pretoria

Salmonella typhi 1971

Type distribution by cases: 2345.

(a) A (77·22); untypable Vi-strains (12·49).

(b) E1 (4·09); DVS (2·89); Vi⁻ (2·55).

(c) D1 (0·38); F1 (0·12); 42 (0·12); B1 (0·04); 46 (0·04).

* DVS: Aliénosensible.

*Cape Province**Salmonella typhi* 1971

Type distribution by cases: 184.

(a) A (78·26); E1 (13·04).

(b) DVS (3·80); untypable Vi-strains (3·26); Vi⁻ (1·08); 46 (0·54).

*Transvaal**Salmonella typhi* 1971

Type distribution by cases: 850.

(a) A (73·52); untypable Vi-strains (16·70).

(b) Vi⁻ (4·00); DVS (3·52); E1 (1·64).

(c) F1 (0·35); D1 (0·23).

DR R. CASSEL – Johannesburg

Salmonella typhi 1973

Type distribution by cases: 2505.

(a) A (77·20); untypable Vi-strains (6·46); DVS (5·86).

(b) E1 (3·43); Vi⁻ (3·07); 46 (1·19); 40 (0·71); D1 (0·63).

(c) 42 (0·27); D4 (0·15); E6 (0·11); 28 (0·11); D6 (0·07); F1 (0·07); 45 (0·07); D2 (0·03); D5 (0·03); D7 (0·03); D12 (0·03); F8 (0·03); G4 (0·03); 34 (0·03); 39 (0·03); 53 (0·03); group VI (?) (0·03).

AMERICA

UNITED STATES OF AMERICA

DR J. J. FARMER III – Atlanta AND JANET V. SIKES

Salmonella typhi

Type distribution by cases: 2138.

(a) DVS* (26·47); E1 (24·79); C1 (8·61); A (6·17); I + IV (5·14); Vi⁻ (3·46); F1 (2·67); K1 (1·73); B1 (1·68); D1 (1·68); 46 (1·59); M1 (1·50); N (1·26); D2 (0·94); D9 (0·94).

(b) 35 (0·75); B2 (0·70); J1 (0·65); 26 (0·65); D7 (0·51).

(c) 28 (0·42); D8 (0·37); E2 (0·37); C4 (0·33); D4 (0·33); F2 (0·33); T (0·28); C2, C9, D6, F8, H, O, 29 (0·23); F4 (0·19); F6 (0·19); C3, D10, E7, E10, 27, 43 (0·14); C5, E3, E9, J2, 25, 36, 37 (0·09); C8, F5, G1, K3, L1, 34, 40, 50 (0·05).

* These include 38 isolates of the chloramphenicol-resistant strain which was epidemic in Mexico.

ASIA

BURMA

Rangoon (strains from National Laboratory)
Results obtained by DR K. B. SHARMA – New Delhi

(1) *Salmonella typhi*

Type distribution by cases: 131.

(a) A (29·0); E1 (25·95); D2 (8·39); DVS (8·39); T (7·63); I + IV (6·10); Vi⁻ (6·10).

(b) D6 (3·05); B1 (0·76); C5 (0·76); D1 (0·76); N (0·76); O (0·76); 42 (0·76); 44 (0·76).

(2) *Salmonella paratyphi* A

Type distribution by cases: 4.

1 (3 strains); untypable (1 strain).

INDIA (several states)

DR K. B. SHARMA – New Delhi

(1) *Salmonella typhi*

Type distribution by cases: 3231.

(a) A (72·23); E1 (10·83); Vi⁻ (3·28); O (2·84); K1 (2·81).

(b) DVS (2·16); D6 (1·64); D1–N (0·86); C5 (0·55); I + IV (0·55).

(c) J1 (0·47); D1 (0·28); T (0·18); 46 (0·18); 42 (0·18); B3 (0·12); 36 (0·12); 40 (0·12); 28 (0·09); F6 (0·06); G1 (0·06); E9 (0·03); E11 (0·03); B2 (0·03); F1 (0·03); F5 (0·03); J4 (0·03); 47 (0·03); 50 (0·03); 51 (0·03).

(2) *Salmonella paratyphi* A

Types distribution by cases: 627.

(a) 2 (45·77); 1 (38·25); 6 (8·27).

(b) 3 (4·76); untypable (2·85).

ISRAEL

DR J. TREISTMAN – Tel Aviv

(1) *Salmonella typhi*

Type distribution by cases: 717.

(a) DVS (21·48); A (23·29); E1 (11·30); untypable (6·83); C1 (6·28); D1 (4·88); F1 (4·46); Vi⁻ (3·90); 40 (2·51); D4 (2·09); 46 (1·39).

(b) 28 (1·67); 27 (1·26); 42 (1·26); J1 (1·16); 50 (1·16); L1 (0·98); D5 (0·70); T (0·70).

(c) B2 (0·28); C2 (0·28); C4 (0·28); C5 (0·28); D6 (0·28); D8 (0·28); F4 (0·14); G3 (0·14); L2 (0·14); M1 (0·14); O (0·14); 36 (0·14); 38 (0·14); 43 (0·14).

Type distribution by foci: 384.

(a) A (18·23); DVS (18·23); E1 (11·98); untypable (7·29); C1 (5·99); F1 (5·99); D1 (4·95); Vi⁻ (4·43); 40 (3·65); 28 (2·34); 46 (2·34); D4 (2·08); 27 (2·08); D5 (1·30).

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(b) J1 (1·30); T (1·04); 50 (1·04); L1 (0·78); C2 (0·52); C4 (0·52); D8 (0·52); 42 (0·52).

(c) B2 (0·26); D6 (0·26); F4 (0·26); G3 (0·26); L2 (0·26); M1 (0·26); O (0·26); 36 (0·26); 38 (0·26); 43 (0·26).

(2) *Salmonella paratyphi B**

Type distribution by cases: 429.

(a) Untypable (28·21); atypical (17·72); 2 var. 2 (13·95); Dundee (8·86); 3aI (7·69); 3a var. 4 (5·36); BAOR (5·36); 3aI var. 4 (3·26); Taunton (2·56); 1010 (1·40); 3a var. 2 (1·17); 3aI var. 6 (1·17); 3b var. 8 (0·93); 2 var. 3 (0·47); 3aI var. 5 (0·47); 1 var. 6 (0·23); 2 (0·23); 3a (0·23); 3a var. 3 (0·23); 3a var. 5 (0·23); Jersey (0·23); Battersea (0·23).

JAPAN

PROF. DR HIDEO FUKUMI – Tokyo

(1) *Salmonella typhi*

Type distribution by cases: 839.

(a) D2 (23·0); E1 (13·0); D1 (9·2); B2 (9·1); M1 (8·7); DVS (8·1); 53 (7·4); E11 (3·5); A (3·1); H (3·1); untypable strains (3·0).

(b) Vi⁻ (2·7); B1 (1·3); 46 (1·2); D6 (0·83); K1 (0·59); 39 (0·59).

(c) M3 (0·36); D12 (0·24); 41 (0·24); C5 (0·12); D10 (0·12); E2 (0·12); L1 (0·12); 47 (0·12); 50 (0·12).

Type distribution by foci: 566.

(a) D2 (26·0); E1 (12·0); M1 (12·0); D1 (10·0); DVS (7·6); 53 (6·0); A (4·6); untypable strains (4·2); Vi⁻ (4·1); B2 (3·2).

(b) H (2·1); 46 (1·8); B1 (1·2); D6 (1·2); E11 (1·2); 39 (0·88).

(c) D12 (0·35); K1 (0·35); 41 (0·35); C5 (0·18); D10 (0·18); E2 (0·18); M3 (0·18); 47 (0·18); 50 (0·18).

(2) *Salmonella paratyphi A*

Type distribution by cases: 38.

(a) 4 (37); 1 (34); untypable strains (24).

(b) 3 (2·8); 5 (2·8).

Type distribution by foci: 36.

(a) 1 (36); 4 (33); untypable strains (25).

(b) 3 (2·5); 5 (2·5).

(3) *Salmonella paratyphi B*

Type distribution by cases: 79.

(a) 1 (33); 3a (24); untypable strains (14); 2 (13); Dundee (6·2).

(b) Beccles (5·0); 3aI (1·2); 3b (1·2); Worksop (1·2); BAOR (1·2).

Type distribution by foci: 74.

(a) 1 (35); 30 (23); untypable strains (15); 2 (11); Beccles (5·4).

(b) Dundee (5·4); 3aI (1·3); 3b (1·3); Worksop (1·3); BAOR (1·3).

* 139 strains were isolated from man; 290 strains were isolated from sewage.

AUSTRALASIA

AUSTRALIA

DR J. R. L. FORSYTH – Melbourne

(1) *Salmonella typhi*

Type distribution by cases: 95.

(a) A (21·0); E1 (13·7); DVS (10·5); B2 (6·3); D1 (5·2); C1 (4·2); D2 (4·2); M1 (4·2); I+IV (4·2); C4 (3·1); 46 (3·1); B1 (2·1); F1 (2·1); 40 (2·1); Vi⁻ (2·1); K1 (2·0).

(b) C2 (1·1); D4 (1·1); E4 (1·1); G1 (1·1); O (1·1); T (1·1); 27 (1·1); 28 (1·1); 35 (1·1).

Type distribution by foci: 70.

(a) A (20·0); DVS (11·5); E1 (10·0); I+IV (5·7); B2 (5·7); D1 (5·7); D2 (5·7); B1 (2·9); C1 (2·9); C4 (2·9); M1 (2·9); 40 (2·9); 46 (2·9); Vi⁻ (2·9).

(b) C2 (1·4); D4 (1·4); E4 (1·4); F1 (1·4); G1 (1·4); K1 (1·4); O (1·4); T (1·4); 27 (1·4); 28 (1·4); 35 (1·4).

(2) *Salmonella paratyphi* B

Type distribution by human cultures: 20.

Taunton (8 strains); 3aI var. 1 (4 strains); Dundee (4 strains); 3a (1 strain); 3b var. 9 (1 strain); BAOR (1 strain); Dundee var. 1 (1 strains).

Type distribution in water or sewage samples: 42.

Taunton (23 strains); 1 (8 strains); 3aI var. 1 (5 strains); Dundee (3 strains); 3aI (2 strains); untypable (1 strain).

PHILIPPINES

DR J. R. L. FORSYTH – Melbourne

Cultures forwarded by DR V. BASACA-SEVILLA – Manila

Salmonella typhi

Type distribution by cases: 305.

(a) A (45·2); B1 (39·3); DVS (7·9).

(b) E2 (4·6); Vi⁻ (1·3); I+IV (1·0); C1 (0·7).

TONGA

DR J. R. L. FORSYTH – Melbourne

Salmonella typhi

Type distribution by cases: 306.

(a) E1 (87·6).

(b) A (9·10).

(c) I+IV (2·3).

NEW ZEALAND

DR R. A. ROBINSON – Wellington

*New Zealand**Salmonella typhi*

1970 – 21 cases.

(a) E1 a (85·71); A (4·76); I+IV (4·76); DVS (4·76).

1971 – 11 cases.

(a) E1 a (54·54); DVS (36·36); 46 (9·09).

1972 – 10 cases.

(a) E9 (30·0); E1 a (20·0); DVS (20·0); Vi⁻ (20·0); A (10·0).

1973 – 12 cases.

(a) E1 a (50·0); E9 (25·0); C1 (8·33); DVS (8·33); Vi⁻ (8·33).*Western Samoa**Salmonella typhi*

1970 – 26 cases.

(a) E1 a (57·69); E9 (42·31); DVS (3·84).

1971 – 10 cases.

(a) E1 a (90·0); Vi⁻ (10·0).

1972 – 25 cases.

(a) E1 a (52·0); E9 (40·0); A (4·0); Vi⁻ (4·0).

1973 – 18 cases.

(a) E1 a (55·56); E9 (22·22); DVS (11·11); Vi⁻ (5·56).*Fiji**Salmonella typhi*

1970 – 1 case: E1 a.

*British Solomon Islands**Salmonella typhi*

1973 – 1 case: E1 a.

EUROPE

AUSTRIA

DR W. ROSCHKA – Graz

(1) *Salmonella typhi*

Type distribution by cases: 152.

(a) A (46·71); E1 (25·00); C (7·23); F (5·92); I+IV (3·94).

(b) D (4·60); B (3·28); DVS (1·97); N (1·31).

(2) *Salmonella paratyphi B*

Type distribution by cases: 872.

(a) Taunton (35·55); 1 (26·06); 3a1 (7·91); Dundee (7·91); 3a (6·65); 3b (5·73); degrad. (4·58); BAOR (2·98); Beccles (1·72); 3a1 var. 2 (0·57).

(b) Worksop (0·35).

BELGIUM

PROF. J. BEUMER – Brussels

(1) *Salmonella typhi*

Type distribution by cases: 311.

(a) A (25·95); E1 (22·13); C1 (19·08); D1 (4·58); 46 (4·58); D9 (3·05); DVS (3·05); F1 (2·29); Vi⁻ (2·29).

(b) C3 (1·52); D6 (1·52); 38 (1·52); 42 (1·52); C4 (0·76); D10 (0·76); G1 (0·76); M1 (0·76); 28 (0·76); 32 (0·76); 40 (0·76); 51 (0·76); 53 (0·76).

(2) *Salmonella paratyphi* B

Type distribution by cases: 83.

(a) Dundee (45·78); 3aI (15·66); untypable (14·45); 1 (10·80).

(b) Jersey (8·43); BAOR (4·81).

BULGARIA

DR ROSA COHEN – Sofia

Salmonella typhi

Type distribution by cases: 77

(a) Untypable Vi⁺ (37·66); A (23·37); E1 (16·88); Vi⁻ (10·38); F (2·59); F1-N (2·59); 46 (2·59).

(b) C (1·28); D (1·28); 45 (1·28).

Type distribution by foci: 67.

(a) Untypable Vi⁺ (43·28); A (17·91); E1 (13·43); Vi⁻ (11·94); F (2·98); F1-N (2·98); 46 (2·98).

(b) C (1·49); D (1·49); 45 (1·49).

CZECHOSLOVAKIA

DR J. BORECKA – Bratislava

(1) *Salmonella typhi*

Type distribution by cases: 747.

(a) E1a (23·03); D1 (22·36); A (18·47); F1 (9·10); DVS (8·30); C1 (3·48); 46 (3·48).

(b) Vi⁻ (1·74); J1 (1·34); D9 (1·34); D6 (1·07); I+IV (1·07); F5 (0·94); B2 (0·67); D2 (0·67); D4 (0·54).

(c) 40 (0·40); D8 (0·40); C4 (0·40); B1 (0·27); E1b (0·27); F2 (0·13); G1 (0·13); C5 (0·13); 34 (0·13); E7 (0·13).

Type distribution by foci: 501

(a) E1a (22·95); D1 (19·56); A (18·76); DVS (10·37); F1 (7·38); 46 (4·79); C1 (4·19); Vi⁻ (2·0).

(b) D9 (1·4); D6 (1·4); I+IV (1·2); D4 (0·8); J1 (0·8); D2 (0·6); 40 (0·6).

(c) B1 (0·4); B2 (0·4); E1b (0·4); C4 (0·4); F5 (0·4); F2 (0·2); G1 (0·2); C5 (0·2); 34 (0·2); D8 (0·2); E7 (0·2).

(2) *Salmonella paratyphi B*

Type distribution by cases: 199

(a) Taunton (34·17); Beccles (19·10); 3aI (10·05); untypable (10·05); 1 (8·04); 3a (6·53); BAOR (5·53); atypical strains (3·02); Dundee (2·01); 3b (1·51).

FINLAND

DR HELEN MAKELA – Helsinki

(1) *Salmonella typhi*

Type distribution by cases: 29.

Type distribution by foci: 20.

(2) *Salmonella paratyphi B*

Type distribution by cases: 208.

(a) Taunton (57·7); 3aI var. 1 (27·4); NST (3·4).

(b) Jersey (1·9); Worksop (1·9); 1 var. 5 (1·0); 3a (1·0).

(c) 1 (0·5); 3a var. 4 (0·5).

Not typed: 10 cases.

Type distribution by foci: 174.

(a) Taunton (54·5); 3aI var. 1 (29·3); NST (4·0).

(b) Jersey (1·7); Worksop (1·7); 1 var. 5 (1·2); 3a (1·2).

(c) 1 (0·6); 3a var. 4 (0·6).

Not typed: 9 foci.

FRENCH CENTRE

DR J. F. VIEU – Paris

(I) FRANCE

(1) *Salmonella typhi*: 1549 strains*.

(a) E1a (31·43); A (20·33); C1 (11·55); DVS (9·17); D1 (6·64); 46 (3·36); B2 (3·29); F1 (2·51); Vi⁻ (2·25); I+IV (2·19); 42 (1·16); untypable (1·06); 34 (0·71); E1b (0·58); 28 (0·58).

(b) C4 (0·58), N (0·51).

(c) J1 (0·38); M1 (0·32); T (0·19); 40 (0·19); C2 (0·13); D2 (0·13); G1 (0·13); 38 (0·13); C3 (0·06); C9 (0·06); D4 (0·06); L1 (0·06); L2 (0·06); 43 (0·06); 47 (0·06).

* 1970: 347; 1971: 399; 1972: 372; 1973: 431 (32 different phage types and groups).

(2) *Salmonella paratyphi B*: 1407 strains.

(a) 1 (29·63); Dundee (23·45); Taunton (20·11); untypable (7·39); Jersey (6·46); Beccles (5·04).

(b) 3aI (3·41); 3b (2·27); 3a (1·20).

(c) BAOR (0·49); Battersea (0·49).

(II) AFRICA

Cameroon – DR HUET – Yaoundé

Salmonella typhi: 346 strains.

- (a) A (63·58); C1 (30·54).
- (b) DVS (2·31); Vi⁻ (2·07); 34 (0·58).
- (c) D1 (0·29); E1 (0·29); N (0·29); I + IV (0·29).

Central African Republic – DR BOUNARDOT and DR DARRIGOL – Bangui

Salmonella typhi: 58 strains.

- (a) C1 var. Centre Afrique (41·37); E1 (37·93).
- (b) A (17·24); 53 (1·72); Vi⁻ (1·72).

Chad – DR DELPY and DR LEFEVRE – N'djamena

Salmonella typhi: 55 strains

- (a) E1 (52·72); A (30·90); D2 (5·45).
- (b) Vi⁻ (5·45); D1 (1·81); 42 (1·81); DVS (1·81).

Egypt – DR HABLAS and DR SANBORN – Cairo (before the creation of the Egyptian Centre)

Salmonella typhi

Type distribution by cases: 169 strains.

- (a) C1 (22·48); A (17·15); DVS (17·15); Vi⁻ (13·01); E1 (7·10); E2 (6·50); G1 (3·55); I + IV (3·55).
- (b) T (2·36); 40 (2·36); 42 (1·77); C4 (0·59); D1 (0·59); D11 (0·59); J1 (0·59); L2 (0·59).

Ethiopia – DR HABLAS – Cairo

Salmonella typhi: 23 strains.

- (a) O (39·13); A (26·08); DVS (17·39); E1 (8·69).
- (b) C5 (4·34); I + IV (4·34).

Ghana – DR VÖRÖS – Accra

Salmonella typhi: 43 strains.

- (a) A (41·86); C1 (32·55); DVS (9·30); E1 (6·97).
- (b) Vi⁻ (4·65); C4 (2·32); 43 (2·32).

Ivory Coast – DR LE NOC – Abidjan

Salmonella typhi: 19 strains.

- (a) A (47·36); C1 (10·52); D1 (5·26); Vi⁻ (31·57).

Malagasy Republic (Madagascar) – DR MAYOUX and DR BRYGOO – Tananarive

Salmonella typhi: 159 strains.

- (a) E1a (54·87); A (31·38).

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(b) C4 (9·23); F5 (1·02); C1 (0·51); E1 b (0·51); T (0·51); 28 (0·51); 42 (0·51); DVS (0·51); I + IV (0·51).

Morocco – PROF. ALAOU, DR DUFOUR, DR MAILLOUX and DR NEJMI – Rabat and Tangier

Salmonella typhi: 1230 strains.

(a) C1 (42·84); E1 a (19·02); DVS (10·48); D1 (6·91); A (5·82); Vi⁻ (3·82).

(b) 42 (3·17); 40 (2·44); B2 (1·62); L2 (1·14); I + IV (0·65); J1 (0·57).

(c) 34 (0·48); D4 (0·40); L1 (0·40); 46 (0·40); E1 b (0·16); C5 (0·08); K1 (0·08); 51 (0·08).

Nigeria – PROF. RAJKOVIC – Zaria

Salmonella typhi: 45 strains.

(a) A (42·22); D2 (26·66); DVS (11·11); Vi⁻ (8·88).

(b) E2 (4·44); D1 (4·44); F1 (2·22).

Senegal – DR LAFaix and DR SARRAT – Dakar

Salmonella typhi: 450 strains.

(a) A (40·88); E1 a (26·44); C4 (11·77); D1 (7·33); DVS (4·88).

(b) Vi⁻ (3·55); C1 (1·11).

(c) B2 (0·44); D6 (0·44); E1 b (0·44); C3 (0·22); 29 (0·22); untypable (0·22); I + IV (0·22).

Somaliland – DR COURTOIS – Djibouti

Salmonella typhi: 53 strains.

(a) E1 (32·07); A (30·18); 40 (7·54); I + IV (7·54); Vi⁻ (7·54); O (5·66).

(b) DVS (5·66); 46 (3·77).

Tunisia – DR BENRACHID – Tunis; DR THIERS – Nabeul

Salmonella typhi: 247 strains.

(a) A (43·72); E1 a (39·67).

(b) DVS (15·26); C5 (2·85); 42 (2·83); Vi⁻ (2·83); D1 (0·81).

(c) C1 (0·40); E1 b (0·40); O (0·40); 34 (0·40); I + IV (0·40).

Upper Volta – DR RICOSSÉ – Bobo-Dioulasso

Salmonella typhi: 158 strains.

(a) A (74·68); Vi⁻ (6·96); E1 (6·33).

(b) DVS (6·33); C1 (2·53); 42 (1·90); I + IV (1·26).

Zaire – DR VAN OYE, DR VANDEPITTE, DR GHYSELS – Brussels

Salmonella typhi: 149 strains.

(a) E1 a (28·85); C1 var. C.A. (18·79); DVS (17·44); A (14·76); G1 (7·38).

(b) O (7·38); Vi⁻ (3·35); B2 (0·67); C1 (0·67); 46 (0·67).

(III) AMERICA

Chile – DR CORDANO – Santiago

Salmonella typhi: 29 strains.

- (a) 46 (41·38); E1 (31·03); F1 (6·89); A (2·44); D4 (3·44); M1 (3·44).
(b) DVS (3·44); I + IV (3·44); Vi⁻ (3·44).

Mexico – DR BESSUDO and DR CIFUENTES – Mexico

Salmonella typhi: 284 strains (from which 274 for 1973).*

- (a) A (78·87); E1 (10·58).
(b) 26 (3·16); Vi⁻ (3·16).

Peru – DR GARDINI – Lima

Salmonella typhi: 25 strains.

- (a) B2 (24); Vi⁻ (24); 46 (20).
(b) E1a (4); M1 (4); I + IV (4).

(IV) ASIA

Indonesia – DR SANBORN – Djakarta

Salmonella typhi: 87 strains.

- (a) D2 (19·43); I + IV (18·39); A (17·24); Vi⁻ (12·64); M1 (10·34); E1 (5·74); DVS (5·74).
(b) D6 (3·44); 46 (3·44); C2 (1·15); D1 (1·15); E2 (1·15).

Iran – DR POURMANSOUR and DR MACHOUH – Teheran

Salmonella typhi: 82 strains.

- (a) A (28·04); DVS (18·29); F1 (13·41); I + IV (12·19); 28 (9·75); E1 (6·09); 34 (3·65).
(b) Vi⁻ (2·44); C1 (1·22); M1 (1·22); N (1·22); T (1·22); 38 (1·22).

Vietnam – DR NGUYEN-DUC-HOHN and DR GOUDINEAU – Ho-Chi-Minh City

Salmonella typhi: 301 strains.

- (a) I + IV (54·15); D6 (7·97); Vi⁻ (7·30); DVS (4·65); N (2·65); 46 (2·65); C2 (2·32); E1 (1·99); M1 (1·99); B2 (1·32); E7 (0·99); E10 (0·99); M4 (0·99).
(b) D1 (0·66); D2 (0·66); G1 (0·66); M2 (0·66); 28 (0·66); 29 (0·66); 38 (0·66).
(c) E2 (0·33); G3 (0·33); J3 (0·33); 43 (0·33).

(V) OCEANIA

Tahiti and New Caledonia – DR LE GOUDEC – Papeete and DR CHANALET – Noumea

* The majority of the strains of phage type A are resistant to chloramphenicol and belong to the Mexican typhoid epidemic of 1972–3.

Salmonella typhi: 41 strains.

(a) E1 (75·60); 46 (12·19).

(b) A (4·8); alienos. (4·8); Vi⁻ (2·4).

GERMANY (Democratic Republic)

PROF. DR H. RISCHE – Wernigerode (Harz)

(1) *Salmonella typhi*

Type distribution by cases: 3022.

(a) E1 a (20·7); A (10·8); Vi⁻ (10·1); DVS (8·8); F1 (8·0); I+IV (7·1); D1 (6·6); E1 b (6·1); C1 (4·9); D2 (4·3); F4 (4·2).

(b) 46 (1·5); 28 (1·1); D4 (1·0); 40 (0·9); T (0·7); N (0·6); F5 (0·6).

(c) D9 (0·4); D6 (0·3); 38 (0·3); F7 (0·2); 35 (0·2); E7 (0·1); C4 (0·08); J1 (0·08); B2 (0·05); 27 (0·05); C5 (0·03); C9 (0·03); D7 (0·03); F2 (0·03); F6 (0·03); M1 (0·03); 34 (0·03); 42 (0·03); 43 (0·03).

Type distribution by foci: 2515

(a) E1 a (20·7); A (10·7); Vi⁻ (10·2); DVS (9·0); F1 (7·5); I+IV (7·2); D1 (6·6); E1 b (6·1); C1 (4·9); F4 (4·3); D2 (4·2).

(b) 46 (1·5); 28 (1·0); D4 (1·0); 40 (1·0); T (0·5); N (0·5); F5 (0·6).

(c) D9 (0·4); 38 (0·6); D6 (0·3); F7 (0·2); 35 (0·2); E7 (0·1); C4 (0·05); J1 (0·08); B2 (0·05); 27 (0·05); C5 (0·03); D7 (0·03); F2 (0·03); F6 (0·03); M1 (0·03); 34 (0·03); 42 (0·03); 43 (0·03).

(2) *Salmonella paratyphi B*

Type distribution by cases: 1885.

(a) Taunton (32·8); 3aI (22·2); 1 (14·3); BAOR (9·4); untypable (8·8); 3a (6·5); Dundee (2·4); 3b (2·0); Jersey (0·9); Beccles (0·8).

Type distribution by foci: 1428

(a) Taunton (34·3); 3aI (19·1); 1 (14·4); BAOR (9·8); untypable (9·3); 3a (6·6); Dundee (2·6); 3b (1·8); Jersey (1·1); Beccles (1·0).

GERMANY (Federal Republic)

PROF. DR H. BRANDIS – Bonn

(1) *Salmonella typhi*

Type distribution by cases: 1803.

(a) E1 a (19·3); A (17·3); DVS (11·14); E1 b (6·32); F1 (7·59); D1 (6·04); I+IV (5·93); Vi⁻ (5·71); C1 (5·21); D2 (2·49); 46 (1·88); 28 (1·77).

(b) 40 (0·83); D4 (0·77); F4 (0·77); N (0·72); 38 (0·61); B2 (0·61).

(c) C2 (0·38); M1 (0·33); 32 (0·33); D9 (0·33); D6 (0·33); 27 (0·33); F5 (0·33); J1 (0·27); C4 (0·27); O (0·22); C3 (0·22); C5 (0·22); E10 (0·22); T (0·16); rough strains (0·16); E7 (0·11); F7 (0·11); C9 (0·05); D8 (0·05); E4 (0·05); 35 (0·05); 50 (0·05); 36 (0·05); E3 (0·05); F6 (0·05); 51 (0·05).

Type distribution by foci: 1409 (without the number of foci of the regional laboratory of Frankfurt a. M.).

(a) E1a (21·78); A (16·89); DVS (10·29); F1 (7·94); C1 (5·96); D1 (5·96); E1b (5·6); I + IV (5·53); Vi⁻ (5·39); D2 (2·2); 46 (1·98); 28 (1·63).

(b) B2 (0·78); D4 (0·78); F4 (0·7); 40 (0·63).

(c) rough strains (0·56); 38 (0·49); 27 (0·42); N (0·42); F5 (0·37); C5 (0·28); D9 (0·28); M1 (0·28); O (0·28); 32 (0·28); D6 (0·28); E10 (0·28); J1 (0·21); C4 (0·21); E7 (0·21); T (0·14); C2 (0·14); F7 (0·14); 36 (0·07); 50 (0·07); E4 (0·07); C3 (0·07); 35 (0·07); 51 (0·07); E3 (0·07).

(2) *Salmonella paratyphi B*

Type distribution by cases: 1846.

(a) Taunton (43·82); 1 m.c. (9·37); untypable (7·20); 3aI m.c. (7·09); BAOR (5·9); 3a m.c. (4·65); Dundee (4·27); 3aI var. 1,2 (3·68); rough strains (2·60); 3b m.c. (2·11); Beccles (2·0); 3aI var. (1·78); 1 var. (1·46).

(b) 3aI var. 4 (0·86); Jersey (0·54); Worksop (0·54); 1 var. 1 (0·54).

(c) 3a var. 4 (0·32); 3b var. 5 (0·32); 3b var. 2 (0·21); Dundee var. 1 (0·3); 3a var. 2 (0·16); 3b var. 3 (0·10); 3b var. 4 (0·10); Beccles var. (0·5).

Type distribution by foci: 1289 (without the number of foci of the regional laboratory of Frankfurt a. M.).

(a) Taunton (37·85); 1 m.c. (10·15); BAOR (7·37); untypable (6·43); 3aI var. 1 (4·88); 3a m.c. (4·80); Dundee (4·57); 3aI (4·03); rough strains (3·25); 3aI m.c. (3·18); Beccles (2·55); 1 var. (2·01); 3aI var. (1·62); 3b m.c. (1·24); 3aI var. 4 (1·24).

(b) 3b (0·93); Jersey (0·77); 3a var. 4 (0·54); 3b var. 5 (0·46); Worksop (0·38); 3b var. 2 (0·31); 3aI var. 2 (0·23); 1 var. 1 (0·23); Dundee var. 1 (0·23); 3b var. 3 (0·15); 3a var. 2 (0·15); 3a (0·15); 2 (0·07); Beccles var. (0·07).

HUNGARY

DR HEDDA MILCH – Budapest

(1) *Salmonella typhi*

Type distribution by cases: 3555

(a) A (20·9); E1a (19·7); D1 (15·4); F1 (10·9); DVS (7·1); C1 (5·9); Vi⁻ (5·5); B2 (3·3); I + IV (2·4).

(b) 46 (1·4); D9 (1·3); E1b (0·9); C4 (0·8); D2 (0·8); D4 (0·6); C2 (0·5).

(c) 28 (0·4); B3 (0·3); D6 (0·2); 27 (0·2); B1 (0·1); C9 (0·1); D8 (0·1); D10 (0·1); F2 (0·1); F3 (0·1); F5 (0·1); G1 (0·1); G2 (0·1); J (0·1); 26 (0·1); 38 (0·1); 40 (0·1); 48 (0·1); 50 (0·1).

Type distribution by foci: 3355

(a) A (20·8); E1a (19·8); D1 (15·5); F1 (11·0); DVS (7·2); C1 (5·6); Vi⁻ (5·5); B2 (3·2); I + IV (2·5).

(b) 46 (1·4); D9 (1·3); C4 (0·9); E1b (0·9); D2 (0·8); D4 (0·6); C2 (0·5).

(c) 28 (0·4); B3 (0·3); D6 (0·2); B1 (0·1); C9 (0·1); D8 (0·1); D10 (0·1); F2 (0·1);

F3 (0·1); F5 (0·1); G1 (0·1); G2 (0·1); J (0·1); 26 (0·1); 27 (0·1); 38 (0·1); 40 (0·1); 48 (0·1); 50 (0·1).

(2) *Salmonella paratyphi B*

Type distribution by cases: 681

(a) Taunton (36·2); BAOR (21·2); 1 (8·3); 3aI var. 2 (5·7); nt (5·4); 3a var. 3 (4·3); atypical (3·7); Dundee (2·9); 3b var. 3 (2·8).

(b) Beccles (2·1); 3a (1·6); 3aI (1·3); 1 var. 1 (1·0); 3b (1·0); 1 var. 3 (0·6).

(c) 3a var. 1 (0·4); 1 var. 2 (0·3); 3aI var. 1 (0·3); 3aI var. 3 (0·3); 3b var. 2 (0·3); 3a var. 4 (0·1); 3b var. 4 (0·1); Jersey (0·1).

Type distribution by foci: 610

(a) Taunton (39·3); BAOR (16·2); 1 (8·9); nt (5·9); 3aI var. 2 (5·5); atypical (4·1); 3a var. 3 (3·6); Dundee (2·9); 3b var. 3 (2·8).

(b) Beccles (2·3); 3a (1·8); 3aI (1·5); 1 var. 1 (1·1); 3b (1·1); 1 var. 3 (0·7); 3a var. 1 (0·5).

(c) 1 var. 2 (0·3); 3aI var. 1 (0·3); 3aI var. 3 (0·3); 3b var. 2 (0·3); 3a var. 4 (0·2); 3b var. 4 (0·2); Jersey (0·2).

ITALY (Central)

PROF. RODOLFO NEGRI – Rome

Salmonella typhi

Type distribution by cases: 1326.

(a) A (43·06); C1 (17·19); E1 (7·99); DVS (7·39); D1 (7·23); I+IV (6·86).

(b) A degraded (5·42); Vi⁻ (1·43); B1 (0·82); F1 (0·82); B2 (0·60); C4 (0·52).

(c) N (0·30); C2 (0·22); 46 (0·07).

PROF. A. GIOVANARDI – Milan

(1) *Salmonella typhi*

Type distribution by cases: 542.

(a) A (35·42); C1 (20·66); I+IV (12·73); DVS (9·22); E1 (8·11); D1 (7·01).

(b) Vi⁻ (2·02); F1 (1·81); B1 (0·73); B2 (0·55).

(c) C2 (0·36); E2 (0·36); M (0·36); N (0·36); B3 (0·18).

Type distribution by foci: 521.

(a) A (34·74); C1 (20·72); I+IV (12·85); DVS (9·21); E1 (8·44); D1 (7·10).

(b) Vi⁻ (2·11); F1 (1·72); B1 (0·76); B2 (0·57); C2 (0·38).

(c) E2 (0·38); M (0·38); N (0·38); B3 (0·19).

(2) *Salmonella paratyphi B*

Type distribution by cases: 141.

(a) Untypable (21·27); BAOR (20·56); Taunton (19·14); 1 (17·02); Dundee (5·67); 3a (4·96); Beccles (3·54); Jersey (2·83).

(b) 3aI (0·70); 3aI var. 6 (0·70).

Type distribution by foci: 98.

(a) Untypable (25·51); Taunton (21·42); 1 (18·36); Dundee (7·14); BAOR (7·14); 3a (7·14); Jersey (4·08).

(b) Beccles (4·08); 2 (3·06); 3aI (1·02); 3aI var. 6 (1·02).

PROF. M. CEFALU – Palermo

(1) *Salmonella typhi*

Type distribution by cases: 349.

(a) A (65·33); C1 (11·75); D1 (6·02); DVS (3·44); V⁻ (3·15).

(b) C4 (2·58); E1 (2·58); untypable (2·01); C2 (0·86); B2 (0·57); E10 (0·57); 46 (0·57).

(c) F4 (0·29); C3 (0·29).

(2) *Salmonella paratyphi A*

Type distribution by cases: 1 (1970) type 1

(3) *Salmonella paratyphi B*

Type distribution by cases: 17 (1972)

(a) Untypable (76·47); 1 Dundee (17·65).

(b) 1 (5·88).

NETHERLANDS

DR P. A. M. GUINEE – Bilthoven

(1) *Salmonella typhi*

Type distribution by cases: 236.

(a) E1a (22·5); DVS (20·8); A (15·2); D1 (9·7); C1 (7·2); Vi⁻ (6·8); D2 (3·0); F1 (2·5); untypable (2·1).

(b) 28 (1·3); 29 (1·3); 32 (1·3); 54 (1·3); F4 (0·8); J1 (0·8); C3 (0·4); C4 (0·4); D4 (0·4); D7 (0·4); D9 (0·4).

(2) *Salmonella paratyphi B*

Type distribution by cases: 249.

(a) Taunton (B7) (26·1); 3aI (B6) (12·0); untypable (11·2); Jersey (J3) (10·8); 1 of Faud C (8·8); BAOR (M5) (5·6); Dundee (A6) (4·0); 3a (B1) (2·8); 3aI var. 1-2 (B3) (2·4); Beccles (A3) (2·4); Beccles (BM3) (2·0).

(b) 3a (S1) (1·6); Dundee (BT6) (1·6); 3aI var. 1-2 (S3) (1·2); 3a var. 4 (S5) (1·2); 3b (S1) (1·2); 3b var. 2 (A5) (1·2); 3aI (B4) (0·8); 3aI (S6) (0·8); Taunton (A7) (0·8); 3b var. 1 (M1) (0·8); Beccles (P3) (0·4).

NORWAY

DR R. SAXHOLM – Oslo

(1) *Salmonella typhi*

Type distribution by cases: 6.

A (5 cases); E1 (1 case).

(2) *Salmonella paratyphi B*

Type distribution by cases: 17.

1 (3 cases); 3a (5 cases) and 1 focus; 3aI (3 cases) and 1 focus; Dundee (2); untypable (4).

ROMANIA

DR M. POPOVICI – Bucarest

(1) *Salmonella typhi*

Type distribution by cases: 140.

(a) E1 (19·63); A (16·06); DVS (11·77); D1 (11·02); F1 (8·71); D9 (8·21); I+IV (7·79).

(b) 46 (4·08); Vi⁻ (3·85); F6 (2·64); C1 (2·42); 51 (1·50); D6 (0·93).

(c) D4 (0·28); D10 (0·28); F5 (0·21); 40 (0·14); C4 (0·07); D2 (0·07); L2 (0·07); 28 (0·07); 38 (0·07); 48 (0·07).

Type distribution by foci: 861.

(a) E1 (19·39); A (18·00); DVS (12·89); F1 (10·34); I+IV (8·94); D9 (7·54); D1 (6·28); 46 (5·34).

(b) Vi⁻ (4·88); C1 (2·80); D6 (0·93); 51 (0·69).

(c) D4 (0·33); F5 (0·33); F6 (0·22); 40 (0·22); C4 (0·11); D2 (0·11); D10 (0·11); L2 (0·11); 28 (0·11); 38 (0·11); 48 (0·11).

(2) *Salmonella paratyphi B*

Type distribution by cases: 36.

(a) Untypable (41·66); atypical (27·78); 1 (16·60).

(b) 3a1 (2·78); 3a var. 4 (2·78); 3b var. 3 (2·78); Taunton (2·78); Dundee (2·78).

Type distribution by foci: 28.

(a) atypical (35·71); untypable (28·57); 1 (17·85).

(b) 3a1 (3·57); 3a var. 4 (3·57); 3b var. 3 (3·57); Taunton (3·57); Dundee (3·57).

SPAIN

DR JOSE RUIZ MERINO—Madrid

(1) *Salmonella typhi*

Type distribution by cases: 90.

(a) A (42·2); E1 (27·7); D9 (14·4); 46 (8·8).

(b) D1 (2·2).

(c) C1 (1·1); D5 (1·1); D6 (1·1); T (1·1); 34 (1·1).

(2) *Salmonella paratyphi B*

Type distribution by cases: 41.

(a) BAOR (48·78); Taunton (43·90).

(b) Beccles (7·31).

SWEDEN

DR L. O. KALLINGS and DR A. A. LINDBERG, Stockholm

(1) *Salmonella typhi*

Type distribution by cases: 56.

(a) E1 (25·0); C1 (14·2); A (10·7); O (7·14); F1 (5·35); D9 (3·57); N (3·57); 34 (3·57); Vi⁻ (3·57); DVS (3·57).

(b) B2 (1·78); C3 (1·78); C5 (1·78); E4 (1·78); M1 (1·78); 28 (1·78); 38 (1·78); 40 (1·78); 46 (1·78); 51 (1·78); untypable Vi strain (1·78).

(2) *Salmonella paratyphi B*

Type distribution by cases: 189.

(a) 1 (22·22); 3a var. 2 (21·16); Taunton (16·93); Dundee (12·69); 3aI var. 4 (3·17); 3b (2·64); 1 var. 2 (2·11); 3a var. 4 (2·11); 3aI var. 1 (2·11); uncommon types (2·11).

(b) 3a (1·58); Jersey (1·58); Beccles (1·58); 3aI (1·05); Dundee var. 2 (1·05); 3b var. 3 (1·05); Beccles var. 2 (1·05); BAOR (1·05); Dundee var. 2 (1·05); untypable strains (1·05); 1 var. 3 (0·52); 1 var. 8 (0·52); Dundee var. 1 (0·52).

Type distribution by cases: 116.

(a) Taunton (24·13); Dundee (20·6); 1 (12·05); 3aI var. 4 (4·31); 3b (4·31); 1 var. 2 (3·44); 3a var. 4 (3·44); 3aI var. 1 (3·44); uncommon types (3·44); Jersey (2·58); Beccles (2·58).

(b) 3a (1·72); 3aI (1·72); 3b var. 3 (1·72); Beccles var. 2 (1·72); BAOR (1·72); Dundee var. 2 (1·72); untypable strains (1·72); 1 var. 3 (0·86); 1 var. 8 (0·86); 3a var. 2 (0·86); Dundee var. 1 (0·86).

SWITZERLAND

PROF. DR H. FEY - Berne

(1) *Salmonella typhi*

Type distribution by cases: 391.

(a) C1 (17·64); DVS (13·29); A (13·04); E1 (9·46); untypable strains (8·18); D1 (6·14); C4 (5·62); N (4·87); D4 (3·52); 46 (2·30); C1 (2·04); C5 (1·27); D2 (1·27); B1 (1·02); E4 (1·02).

(b) 34 (1·02); B2 (0·76); B3 (0·76); D9 (0·76); O (0·76); 38 (0·76); E10 (0·50); group D (0·50); C2 (0·50); T (0·50).

(c) B2 (0·25); C3 (0·25); D10 (0·25); D11 (0·25); F4 (0·25); J1 (0·25); K2 (0·25); L1 (0·25); L2 (0·25); M1 (0·25); 29 (0·25); 40 (0·25); 47 (0·25).

(2) *Salmonella paratyphi B*

Type distribution by cases (number not stated).

(a) Taunton (15·64); 1 var. 2 (14·50); 1010 (9·16); 3aI var. 4 (7·82); Group 1 (6·87); 1 var. 4 (5·33); untypable strains (5·33); Beccles var. 3 (3·81); Group B untypable (3·43); 3aI (3·43); 3aI var. 1 (2·48); 1 var. 12 (2·09); Jersey (2·09); 3a var. 7 (1·90); Beccles (1·90); untypable group 1 (1·70); Dundee (1·52).

(b) Group 3 (1·33); 3a var. 4 (1·33); Dundee (1·33); 1 var. 3 (1·14); 1 var. 1 (0·76); Beccles var. 4 (0·76); 1 var. 4 (0·57).

(c) 1 (0·38); 1 var. 5 (0·38); 3a (0·38); Taunton (0·38); BAOR (0·38); 1 var. 7 (0·19); 1 var. 10 (0·19); 2a (0·19); 3a var. 2 (0·19); 3a var. 6 (0·19); G (0·19).

UNITED KINGDOM

DR E. S. ANDERSON – London

(1) *Salmonella typhi*

Type distribution by cases (203) of U.K. origin.

(a) E1 (16·3); A (11·8); I+IV (10·3); O (9·9); DVS (8·4); K1 (6·9); 46 (4·9); C1 (4·4); B2 (3·9); D1-N (3·9); F1 (3·9); D1 (3·4); Vi⁻ (2·5).

(b) 28 (2·0); 45 (2·0); B1 (1·0); E4 (1·0); C4 (0·5); D5 (0·5); F4 (0·5); J1 (0·5); M1 (0·5); N (0·5); 51 (0·5).

Type distribution by foci (152) of U.K. origin.

(a) E1 (19·7); A (13·2); I+IV (9·2); DVS (8·6); O (7·9); K1 (5·3); 46 (5·3); C1 (4·6); D1 (4·6); B2 (3·9); Vi⁻ (3·3); F1 (2·6); D1-N (2·0); 28 (2·0).

(b) B1 (1·3); 45 (1·3); C4 (0·7); D5 (0·7); E4 (0·7); F4 (0·7); J1 (0·7); M1 (0·7); N (0·7); 51 (0·7).

Type distribution by cases (532) of foreign origin.

(a) E1 (17·3); DVS (12·4); I+IV (10·0); O (9·4); A (9·2); 46 (7·3); B2 (5·5); C1 (5·3); D1 (3·7); K1 (3·2); Vi⁻ (2·1); 40 (1·7); 51 (1·5); J1 (1·3); 28 (1·3).

(b) D1-N (1·1); D2 (0·9); C5 (0·7); E4 (0·7); F1 (0·7); 45 (0·7); B1 (0·6); D5 (0·6); G1 (0·6); M1 (0·6)

(c) L2 (0·4); 34 (0·4); D6 (0·2); N (0·2); 35 (0·2); 53 (0·2).

Type distribution by foci (474) of foreign origin.

(a) E1 (16·2); DVS (13·1); A (9·7); I+IV (9·7); O (9·3); 46 (7·0); C1 (5·9); B2 (4·9); D1 (3·8); K1 (2·5); Vi⁻ (2·3); 40 (1·7); 51 (1·7); J1 (1·5); 28 (1·5).

(b) D1-N (1·1); C5 (0·8); D2 (0·8); E4 (0·8); F1 (0·8); B1 (0·6); D5 (0·6); G1 (0·6); M1 (0·6); 45 (0·6).

(c) L2 (0·4); 34 (0·4); D6 (0·2); N (0·2); 35 (0·2); 53 (0·2).

(2) *Salmonella paratyphi A**

Type distribution by cases (9) of U.K. origin.

1 (55·6); 2 (11·1); 4 (11·1); untypable r.d.n.c. (11·1); untypable (11·1).

Type distribution by foci (6) of U.K. origin.

1 (33·3); 2 (16·7); 4 (16·7); untypable r.d.n.c. (16·7); untypable (16·7).

Type distribution by foci (71 (72 cases)) of foreign origin.

(a) 1 (46·5); 2 (22·5); 6 (11·3); untypable r.d.n.c. (9·9).

(b) 3 (2·8); 10 (2·8); untypable (2·8); 7 (1·4).

Sixty-five (90·3%) of the cases of foreign origin were infected in the Indian subcontinent.

* r.d.n.c. Reacting with the typing phages to give a pattern of lysis that does not conform to a designated type.

(3) *Salmonella paratyphi B**

Type distribution by cases (334) of U.K. origin.

(a) Taunton (40·4); 1 (26·9); 3a (8·1); 1 var. 1 (6·9); Dundee (6·0); 3b (4·5).

(b) Untypable r.d.n.c. (2·0); 3a var. 4 (1·2); 3aI (1·0); 3aI var. 1 (1·0); 3b var. 1 (0·6); Beccles (0·6); Dundee var. 1 (0·6).

(c) 3a var. 2 (0·3); 3a var. 6 (0·3).

Type distribution by foci (186) of U.K. origin.

(a) 1 (40·9); Taunton (19·9); Dundee (8·6); 3a (8·1); 1 var. 1 (7·5); untypable r.d.n.c. (3·2); 3b (2·7).

(b) 3a var. 4 (1·6); 3aI (1·6); 3aI var. 1 (1·6); 3b var. 1 (1·1); Beccles (1·1); Dundee var. 1 (1·1); 3a var. 2 (0·5); 3a var. 6 (0·5).

Type distribution by cases (184) of foreign origin.

(a) Taunton (40·8); Dundee (26·6); 3b var. 1 (4·9); 3aI var. 1 (4·3); 1 (3·8); 3a var. 4 (3·3); Beccles (3·3); 1 var. 1 (2·2); 3a (2·2).

(b) 1 var. 4 (1·1); 3a var. 6 (1·1); BAOR (1·1); Dundee var. 1 (1·1); untypable r.d.n.c. (1·1); untypable (1·1); 3aI (0·5); 3aI var. 4 (0·5); Taunton var. 1 (0·5).

Type distribution by foci (148) of foreign origin.

(a) Taunton (41·2); Dundee (23·0); 3aI var. 1 (5·4); 1 (4·1); 3a var. 4 (4·1); Beccles (4·1); 1 var. 1 (2·7); 3b var. 1 (2·7); 3a (2·0).

(b) 1 var. 4 (1·4); 3a var. 6 (1·4); BAOR (1·4); Dundee var. 1 (1·4); untypable r.d.n.c. (1·4); untypable (1·4); 3aI (0·7); 3aI var. 4 (0·7); 3b (0·7); Taunton var. 1 (0·7).

(4) *Salmonella java*

Type distribution by cases (146) of U.K. origin.

(a) Worksop (23·3); Battersea (20·5); 1 var. 9 (13·0); 1 var. 6 (11·6); untypable r.d.n.c. (11·0); 1 var. 3 (8·9).

(b) Dundee (5·5); 3b var. 2 (2·1); 1 var. 4 (1·4); 3b var. 9 (1·4); Beccles var. 2 (0·7); untypable (0·7).

Type distribution by foci (86) of U.K. origin.

(a) Battersea (26·7); Worksop (23·3); untypable r.d.n.c. (15·1); Dundee (9·3); 1 var. 9 (8·1); 1 var. 6 (7·0).

(b) 1 var. 3 (2·3); 1 var. 4 (2·3); 3b var. 9 (2·3); 3b var. 2 (1·2); Beccles var. 1 (1·2); untypable (1·2).

Type distribution by cases (28) of foreign origin.

1 var. 4 (21·4); 3b var. 9 (17·9); Dundee (17·9); Dundee var. 1 (7·1); Worksop (7·1); untypable r.d.n.c. (7·1); 1 var. 3 (3·6); 1 var. 6 (3·6); 3b var. 8 (3·6); BAOR (3·6); Battersea (3·6); untypable (3·6).

Type distribution by foci (25) of foreign origin:

1 var. 4 (20·0); 3b var. 9 (20·0); Dundee (12·0); Dundee var. 1 (8·0); Worksop (8·0); untypable r.d.n.c. (8·0); 1 var. 3 (4·0); 1 var. 6 (4·0); 3b var. 8 (4·0); BAOR (4·0); Battersea (4·0); untypable (4·0).

* r.d.n.c. Reacting with the typing phages to give a pattern of lysis that does not conform to a designated type.

YUGOSLAVIA (Serbia)

DR NADA STOSIC – Belgrade

(1) *Salmonella typhi*

Type distribution by cases: 552.

- (a) I + IV (31·7); A (20·1); 28 (10·6); D 1 (10·3); F 1 (7·7); E 1 (1·5); DVS (3·9).
 (c) C 1 (0·3); F 3 (0·3); B 1 (0·1); C 4 (0·1); K 1 (0·1).

(2) *Salmonella paratyphi B*

Type distribution by cases: 75.

Taunton (100).

YUGOSLAVIA (Croatia)

DR ZELJKA MIŠIĆ – Zagreb

(1) *Salmonella typhi*

Type distribution by cases (patients and carriers): 904.

(a) A (37·94); E 1 (34·06); D 1 (5·30); F 1 (5·06); C 1 (4·20); DVS (3·87); untypable Vi-strains (2·76).

(b) 46 (1·76); Vi⁻ (1·76); 28 (1·16); C 5 (0·99).

(c) C 7 (0·33); C 2 (0·22); D 9 (0·22); C 4 (0·11); D 4 (0·11); 40 (0·11).

Type distribution by foci: 238

(a) A (26·16); E 1 (21·09); DVS (11·39); F 1 (8·86); D 1 (8·01); C 2 (6·32); untypable Vi-strains (5·06); 46 (2·95).

(b) Vi⁻ (2·95); 28 (2·53); C 5 (2·10).

(c) C 2 (0·42); C 4 (0·42); C 7 (0·42); D 4 (0·42); D 9 (0·42); 40 (0·42).

(2) *Salmonella paratyphi B*

Type distribution by cases (patients and carriers): 83.

(a) Taunton (43·27); 3aI var. 1 (14·45); 3a (12·04); untypable strains (11·70); 1 (10·84).

(b) 3a var. 1 (2·40); 1 var. 1 (1·04); 1 var. 6 (1·04); 1 var. 12 (1·04); 3aI var. 1 (1·04).

Type distribution by foci: 48.

(b) Taunton (41·66); untypable strains (12·54); 3aI var. 1 (12·50); 3a (10·41); 1 (8·33); 3a var. 1 (4·16).

(b) 1 var. 1 (2·08); 1 var. 6 (2·08); 1 var. 12 (2·08); 3aI var. 4 (2·08).

DISCUSSION

The previously observed geographical variations in the distribution of Vi-phage types of the typhoid bacillus (see Report of ICEPT, 1973; Anderson, 1961; Nicolle, 1961 *a, b*) were evident during the period 1970–4.

In general, the studies were most intensive in the developed countries. In other parts of the world, by contrast, the scrutiny was partial or fragmentary. This

resulted in unevenness in the reports: where coverage was comprehensive, so that thousands of strains of *Salmonella typhi* were examined, an accurate picture of the type distribution emerged. However, where the studies were incomplete, usually because of lack of facilities or the shortage and spasmodic submission of cultures, it was evident that the frequency distribution of phage types was distorted. Nevertheless, valuable information was gained from all national centres, and it is hoped that coverage will improve where it is currently incomplete.

Knowledge of the distribution of phage types of *S. typhi* on a worldwide scale continues to contribute materially to the epidemiological study of typhoid fever in each country and between countries.

As in our former reports, two phage types, A and E1, are the most widespread and abundant. However, the tables submitted by the various national centres show the extensive range of phage types that may be permanently or temporarily prevalent in many countries.

'Exotic' phage types are introduced into new countries from time to time, though they do not normally persist, and the characteristic stable type distribution is ultimately restored. But that distribution may be permanently modified by substantial immigration patterns. For example, phage types N, D1-N and O are common on the Indian sub-continent but rare in the United Kingdom. When these types are encountered in Britain, therefore, attention is automatically focused on persons who originated in India, Pakistan or Bangladesh. Imported phage types tend to remain in the ethnic groups from which they originate, since such groups usually congregate in particular areas.

Vi-phage typing thus remains of prime importance in the epidemiology of typhoid fever, both in the investigations of the current disease and in establishing the Vi-type distribution throughout the world – an invaluable source of reference for long-term studies.

An important event during the period covered by this report was the appearance of epidemic strains of *S. typhi* carrying plasmid-determined resistance to chloramphenicol. This was first detected in Mexico, where an epidemic of many thousands of cases with a mortality rate of about 10% (equal to that of the pre-chloramphenicol era) was caused by a chloramphenicol-resistant degraded Vi-strain of the typhoid bacillus, which proved to be carrying a resistance plasmid of a new group: H₁ (Anderson & Smith, 1972). Other chloramphenicol-resistant strains were identified in India (Paniker & Vimala, 1972), Vietnam (Butler *et al.* 1973), Thailand (Lampe, Mansuwan & Duangami, 1974; Anderson, 1974) and Indonesia (see also Anderson, 1975). A range of chloramphenicol-resistant Vi-types were isolated in these south East Asian countries. In all cases the resistance resulted from the carriage of a group H₁ plasmid. This evidently reflected an interlocked epidemiology of the typhoid bacillus in man and of H₁ plasmids in the typhoid bacillus. The reasons underlying this phenomenon are as yet undetermined: but it has been established that wherever epidemic typhoid has involved chloramphenicol-resistant strains of *S. typhi*, group H₁ plasmids have caused that resistance. Moreover, in some of the countries concerned the general incidence of chloramphenicol resistance in *S. typhi* is very high: about 75% in Vietnam by 1974.

The underlying cause of this undesirable situation is, of course, the imprudent use of chloramphenicol in man; but the nature of the special affinity of H₁ plasmids for *S. typhi* is unknown.

The IFEPT will in future report on studies of chloramphenicol resistance in *S. typhi* as a routine.

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