FURTHER STUDIES WITH CULTURES OF SHIGELLA
CLASSIFIED ACCORDING TO THE METHOD
USED IN THE USSR

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SUMMARY: A comparison of the Shigella sero-type designations used in much of the literature emanating from the Soviet Union with those employed in the International Shigella Schema is presented for the use of investigators who are interested in the Russian reports on shigellae and bacillary dysentery. Recent literature dealing with such comparative studies is briefly reviewed.

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In 1959, Ewing *et al.* reported the results of studies with 18 cultures of Shigella classified according to the method in use in the Soviet Union. The purpose of the publication was included in a preface and was as follows:

"Since translations of many of the Russian scientific journals now are available and since there are many articles on Shigella and bacillary dysentery in these journals, it seemed desirable to compare the Shigella nomenclature in use in Russia with the International system of Shigella taxonomy and nomenclature, which is in general use in most other parts of the world."

In the summary of the above-mentioned paper it was stated that the comparative studies were presented for use by

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investigators who are interested in reports emanating from the Soviet Union.

Since 1959 a number of publications have appeared on this subject and additional serotypes have been received from the Soviet Union. Hence, the purpose of this communication is to report the results of our examinations of 32 cultures of Shigella classified according to the method currently in use in the Soviet Union and their orientation in the International Shigella Schema, as well as to review briefly some recent literature on the subject. However, our primary purpose remains the same, i.e., to make available a comparison of the two methods of classification, so that Soviet literature on shigellae and bacillary dysentery may be more completely understood. It is not our purpose to discuss the comparative merits of either system.

Thirty-two cultures of Shigella were received in 1960 from Dr. R. M. Novgorodskaja of the Pasteur Research Institute of Epidemiology, Microbiology and Hygiene, Leningrad. Data that accompanied the cultures included their identification according to the method in use in the Soviet Union as well as their orientation in the International Shigella Schema as determined by Dr. Novgorodskaja and her co-investigators. Also, photographic copies of three of this investigator's recent publications were furnished by Professor V. M. Zhdanov of the USSR Academy of Medical Sciences and Chairman of that country's Committee on Nomenclature of Pathogenic Bacteria. The authors made use of the tabular material in the copies of these publications and are indebted to Dr. Novgorodskaja and Professor Zhdanov for these materials.

The methods used in the examination of the 32 strains of Shigella mentioned above were the same as those reported in earlier publications of the senior author and coworkers.

Cultures of Shigella dysenteriae 1 and S. dysenteriae 2 were not included among the 32 cultures received. However, it appeared quite clear that the names of these serotypes of subgroup A (S. dysenteriae) were synonymous with the designations Grigorjeff-Shiga and Stutzner-Schmitz, respectively (Table 1). The accession numbers of five of the cultures (1676, 2291, 12181, 2012, 2469) received in 1960 were the same as those of certain cultures received and reported earlier (Ewing et al., 1959), but the majority of the strains were different as indicated by different accession numbers.

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The lyophilized (or otherwise dried) culture of strain 246 was nonviable when opened but another strain (4830) of this serotype (Shigella boydii 7, Boyd-Novgorodskaja II) was examined and reported in 1959. The identification of the various cultures and their orientation in the International Shigella Schema is given in Table 1 along with the Soviet designations. It may be noted (Table 1) that in addition to S. dysenteriae 1 and 2 mentioned above, several serotypes were not represented among the 32 cultures received. However, representatives of most of the commonly occurring Shigella serotypes were present in the shipment (Table 1).

The work of Olinici et al. (1958) first came to the authors' attention in 1960 when Dr. N. Olinici, of the Institute of Microbiology, Parasitology, and Epidemiology, Bucharest, kindly furnished a reprint, and a translation in English, of the publication. The investigators reported comparative studies, the results of which are outlined in Table 2. Similarly, Novgorodskaja (1959, 1960) reported on the investigations of cultures of Shigella received from various English, French, and Hungarian collections. It is possible that some of the strains reported upon by Novgorodskaja originated in the International Shigella Center (Atlanta), since cultures were sent in 1956 and 1957, respectively, to the Director of the Centre de Collections de Types Microbiens, Lausanne, and to the World Health Organization, Geneva, for transmittal to Soviet investigators. The results reported by Novgorodskaja (1959, 1960) are outlined in Table 2 along with those of Olinici et al. for comparison with those obtained in the present study (Table 1).

The Flexner serotypes a, b, c, d, e, and f all were mentioned by Novgorodskaja (1959) but counterparts of serotypes a, b, and d were not identified among the cultures reported upon by that investigator in 1959 (Table 2). However, Olinici et al. (1958) reported that cultures of serotype a were S. flexneri 4a and that serotype b was equivalent to S. flexneri 2b. The results reported by Ewing et al. (1959) on the identification of Flexner serotypes a to f (inclusive) agreed with those reported by the aforementioned investigators, except that the Flexner serotype a strain examined in 1959 was a S. flexneri Y variant and the serotype d culture was S. flexneri 3a. The subserotype designations (a1, a2, a3, f1, and f2) employed by Novgorodskaja (1960) apparently were innovations since they did not occur in earlier publications.

Table 1. Identification of cultures of Shigella from the USSR.

Culture No. (Original)	Classification according to International Schema as determined at International Center, Atlanta		Soviet method of designation ¹		
	Center, Atlanta		Species	Subspecies	Serotype
Subgroup A					
*	<u>S. dysenteriae</u>	1	Grigorjeff-Shiga		
*		2	Stutzer-Schmitz		
4662		3	<u>Bact. dysenteriae</u>	Novgorodskaja-Semenova	Roman
2291		4	do	do	1618
1676		5	do	do	819
443		6	do	do	Tjacht
2435		7	do	do	2435
*		8			
*		9			
*		10			
Subgroup B					
2303	<u>S. flexneri</u>	1a	Flexner	Flexner	f(f ₂)
767		1b	do	do	f(f ₁)
729		2a	do	do	c
726		2b	do	do	b
737		3a	do	do	e
*		3b			
414		3c	do	do	d
752		4a	do	do	a(a ₂)
718		4a	do	do	a(a ₁)
2465		4b	do	do	a(a ₃)
1307		5	do	do	g(g ₁)
1007		5	do	do	g(g ₂)

347		6**	Flexner	Newcastle	
339		6	do	do	
358		6	do	do	
271		6	do	do	
790		6	do	do	
808		6	do	do	
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	Subgroup C				
439	<u>S. boydii</u>	1	Flexner	Boyd-Novgorodskaja	I
2012		2	do	do	V
*		3			
4322		4	do	do	III
2619		5	do	do	VII
*		6			
4830		7	do	do	II
*		8			
12181		9	do	do	IV
78		9	do	do	IV
*		10			
*		11			
2469		12	do	do	VI
*		13			
*		14			
*		15			
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	Subgroup D				
946	<u>S. sonnei</u>		Sonne		
523			do		
2374			do		

- ¹ Designations that occurred on the culture labels and in data that accompanied the cultures.
- * Cultures of these serotypes were not received.
- ** The six S. flexneri 6 cultures of three biotypes: Boyd 88 (347, 339), Manchester (358, 271), and Newcastle (790, 808).

Table 2. Results of comparative studies reported by other investigators.

Designations employed in the International Shigella Schema		Novgorodskaja		Olinici et al. (1958)	
		1959	1960		
<u>S. dysenteriae</u>	3	serotype Roman	serotype Roman		
	4	do 1618	do 1618		
	5	do 819	do 819		
	6	do Tiakht	do Tiakht		
	7	do 2435	do 2435		
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<u>S. flexneri</u>	1a	Flexner serotype f	Flexner serotype f2	f	
	1b	-*	do f1	f	
	2a	do c	do c	c	
	2b	-	do b	b	
	3a	do e	do e**	e	
	4a	-	do a2	a	
	4b	-	do a3		
	5		do g1		
	5		do g2		
	6	Newcastle	Newcastle		
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<u>S. boydii</u>	1	Boyd-Novgorodskaja serotype I	I	I	
	2	do V	V	V	
	4	do III	III	III	
	5	do VII	VII	VII	
	7	do II	II	II	
	9	do IV	IV	IV	
	12	do -	VI	-	
<hr/>					
<u>S. sonnei</u>		Sonne			

* The dash (-) indicates that the serotype was not identified among cultures reported upon by Novgorodskaja (1959). Counterparts of serotypes a, b, and d were not encountered and serological type g was not listed in the 1959 publication.

** There apparently is a typographical error in Table 3 of the 1960 publication, since a strain of S. flexneri 3 (5316) is listed therein as serological type c. This probably should have been e rather than c, since cultures of type e examined by various authors have been S. flexneri 3, while cultures of type c have been identified as S. flexneri 2a.

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Also, mention of Flexner serotype g (g1 and g2) did not appear to have occurred earlier, while serotype d mentioned in the 1959 and earlier publications was omitted from Table 3 of the 1960 publication. Parenthetically, it should be noted that the designations 4aA, 5 (x+), and 5 (x-), apparently employed by some investigators in connection with certain S. flexneri serotypes, are not designations employed in the International Shigella Schema, the latest edition of which may be found in the 1958 Report of the International Enterobacteriaceae Subcommittee.

Thus, results of the present study indicated that there was general agreement in most essential points between the comparative studies reported by Olinici (1958), Novgorodskaja (1959, 1960), Ewing et al. (1959) and those reported herein and that the few discrepancies mentioned by Ewing et al. (1959) were clarified.

The classification of Shigella in use in the Soviet Union apparently is based upon one proposed by Troitski (1953; see Novgorodskaja, 1960; or Ravich-Birger et al., 1961 for references), while the International Shigella Schema is based upon the classification and nomenclature proposed by Ewing (1949), as subsequently modified and extended (Reports of the International Enterobacteriaceae Subcommittee, 1950, 1953, 1958). The nomenclature, taxonomic system, and method of serotype designation used in the International Shigella Schema have been favorably acted upon by the Judicial Commission and the Nomenclature Committee of the International Association of Microbiological Societies (International Bulletin of Bacteriological Nomenclature and Taxonomy, 1:147-149, 1951; 2:82-84, 1953; 150-151, 1953; 4:148-149, 1954; 8:195-196, 1958; 10:85, 1960).

Perhaps attention should be directed to the fact that although the existence of some serotypes is recognized by Soviet writers, they are not incorporated in the Soviet classification at present (Ravich-Birger et al., 1961). These include the serotypes recognized in the International Shigella Schema as S. dysenteriae serotypes 3, 4, 5, 6 and 7. These, as well as all other serotypes in subgroups A, B, C, and D of the International Schema, are regarded as serotypes of the four corresponding species, Shigella dysenteriae, S. flexneri, S. boydii, and S. sonnei, respectively. None of the serotypes is recognized as an individual species or subspecies (variety). This includes S. dysenteriae 1 (Shiga's

bacterium) and S. dysenteriae 2 (Schmitz's bacterium), which are recognized only as serotypes of the species S. dysenteriae. Many cultures of S. dysenteriae 3, 4, 5, 6 and 7 have been studied by the senior author for more than twenty years, during which time they were neither more, nor less, variable than other shigellae or members of other bacterial groups. Hence, we cannot agree with the remarks of Ravich-Birger et al. (1961) as regards the above-mentioned serotypes. As a matter of fact, it is the remarkable constancy or stability of these and other bacterial types that might be considered surprising, rather than the converse.

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