

# ON THE CLASSIFICATION OF THE SHIGELLA TYPES

With Special Reference  
to the Flexner Group

BY

STEN MADSEN



EJNAR MUNKSGAARDS FORLAG

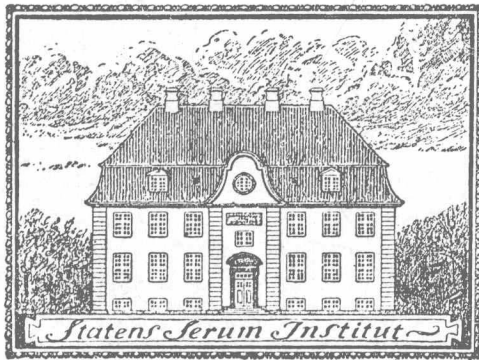
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*Denne afhandling  
er af det lægevidenskabelige fakultet  
ved Københavns Universitet  
antaget til offentlig at forsvares  
for den medicinske  
doktorgrad.*

København, den 3. oktober 1949.

**J. ENGELBRETH-HOLM,**  
h. a. dec.

*Translated from the Danish  
by*

Elisabeth Aagesen

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*Printed in Denmark*  
H. P. Hansens Bogtrykkeri,  
Copenhagen

## Preface.

The present work was carried out in the years 1947—49 at the State Serum Institute in Copenhagen. I am greatly obliged to the director of that Institute, Dr. *J. Ørskov* for the excellent working conditions and facilities placed at my disposal.

Dr. *F. Kauffmann*, chief of the International Salmonella Centre, has guided my studies of bacillary dysentery, and his extensive knowledge of enteric bacteriae has been of inestimable value to me during the performance of this work. I wish to thank him for his never-failing interest and stimulating criticism without which the present work would not have been possible.

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## Contents.

Introduction . . . . .	9
<b>Chapter I.</b>	
Historical Review . . . . .	11
<b>Chapter II.</b>	
<i>Nomenclature and Classification</i> . . . . .	24
<b>Chapter III.</b>	
I. <i>Collection and Preservation of Strains</i> . . . . .	29
II. <i>List of Strains</i> . . . . .	30
<b>Chapter IV.</b>	
<i>Biochemical Investigations</i> . . . . .	35
I. <i>Culture Media and Technique</i> . . . . .	35
II. <i>Present Investigations</i> . . . . .	37
<b>Chapter V.</b>	
I. <i>General Serology</i> . . . . .	49
<i>Technique</i> . . . . .	49
1. <i>Antigens</i> . . . . .	49
2. <i>Immune Sera</i> . . . . .	50
3. <i>Agglutination</i> . . . . .	51
a. <i>Slide agglutination</i> . . . . .	51
b. <i>Tube agglutination</i> . . . . .	51
4. <i>Absorptions</i> . . . . .	51
II. <i>Special Serology</i> . . . . .	52
A. <i>Antigenic Structure of the Flexner Group</i> . . . . .	52
<i>Practical Use of Type-Specific and Group Factor Sera</i> . . . . .	69
<i>Polyvalent Sera</i> . . . . .	69
B. <i>Serological Relationships, Partly within the Shigella Group, and Partly</i> <i>Between this Group and Other Enterobacteriaceae</i> . . . . .	72
1. <i>Previous Investigations</i> . . . . .	72
2. <i>Present Investigations</i> . . . . .	74
a. <i>Relationships within the Shigella Group</i> . . . . .	74
b. <i>Relationships between the Shigella and the Alkalescens Groups</i> . . . . .	78

	Page
C. O-Inagglutinable Strains ... ..	81
1. Previous Investigations ... ..	81
2. Present Investigations ... ..	82

#### Chapter VI.

<i>Discussion</i> ... ..	87
<i>Summary</i> . ... ..	103
<i>Danish summary</i> (Resumé) . ... ..	110
<i>References</i> ... ..	117
<i>Appendix. List of Reagents and Culture Media</i> ... ..	113

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II. <i>Present Investigations</i> . . . . .	37
Chapter V.	
I. <i>General Serology</i> . . . . .	49
<i>Technique</i> . . . . .	49
1. <i>Antigens</i> . . . . .	49
2. <i>Immune Sera</i> . . . . .	50
3. <i>Agglutination</i> . . . . .	51
a. <i>Slide agglutination</i> . . . . .	51
b. <i>Tube agglutination</i> . . . . .	51
4. <i>Absorptions</i> . . . . .	51
II. <i>Special Serology</i> . . . . .	52
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	Page
C. O-Inagglutinable Strains ... ..	81
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2. Present Investigations ... ..	82

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<i>Discussion</i> ... ..	87
<i>Summary</i> . ... ..	103
<i>Danish summary</i> (Resumé) . ... ..	110
<i>References</i> ... ..	117
<i>Appendix. List of Reagents and Culture Media</i> ... ..	113



## Introduction.

A review of the comprehensive literature on dysentery shows plainly the difficulty of arriving at a proper classification of the dysentery group.

The constantly changing nomenclature, the frequent discoveries of new strains, and the difficulty of classifying them in the known systems have caused some confusion and disagreement within the literature on the subject.

Even though the recent investigations, based especially on the antigenic analysis, have contributed to greater stability in classification, the study of the dysentery group still gives rise to so many problems, that I willingly followed the suggestion of *F. Kauffmann* of taking up the entire question for revision.

The aim of the present work has thus been to contribute to an elucidation of the biochemistry and serology of the *Shigella* group, with special reference to the antigenic structure of the *Flexner* group, in which the greatest uncertainty prevails. Attention has here been focused particularly on the classification of strains "X" and "Y" and on the question of the justification of setting up the dual types, suggested among others by *Weil*.

For the routine work we tried to construct serviceable and easily applicable antigenic formulae and to prepare sera suitable for diagnostic purposes.

A number of *alkalescens* strains are included in the investigations but not designated as *Shigella* strains. According to *Kauffmann* (1949) these strains, together with the *dispar* group, are more closely related to the *Escherichia* group.

After a brief historical review the origin of each strain is indicated together with the nomenclature and classification used here. Next the procedure of the investigations is described. Then the biochemical and serological results are given, and finally these are discussed.



## Chapter I.

### HISTORICAL REVIEW

In 1898 *Shiga* (1898 a) reported that he had isolated a bacterium both from the feces and from the intestinal tract of 36 dysentery patients in Japan, a bacterium which agglutinated in fairly high dilutions in serum from these patients, but was not agglutinated by serum from normals. He described the bacillus, which he termed *Bacillus dysenteriae*, as a short, slowly motile rod, rounded at both ends. Morphologically it resembled the typhoid bacillus; it was non-stainable by Gram's method and non-sporing; it did not liquefy gelatine, did not coagulate milk, fermented glucose, and produced no indole. In addition *Shiga* (1898 b) found these bacilli to be toxic to guinea-pigs.

*Shiga* has since commonly been regarded as the discoverer of the dysentery bacillus.

*Chantemesse* and *Widal* had already described "le microbe de la dysenterie epidémique" in 1888. But they did not continue their investigations, which therefore were of no great importance to the dysentery research. The strain was, however, preserved, and in 1903 *Vaillard* and *Dopter* showed that the bacillus was really identical with that isolated by *Shiga*. In France *Chantemesse* and *Widal* are, however, still regarded as the proper discoverers of the dysentery bacillus (*Dopter* 1921).

Two years after *Shiga's* publication *Flexner* (1900), and, at the same time, *Strong* and *Musgrave* (1900), claimed to have found — on the Philippines, in North America and in Puerto Rico — a bacillus corresponding exactly to that described by *Shiga*, which was also slowly motile. Moreover they stated that dysentery could be produced in man by oral administration of the bacillus. *Flexner*, as later demonstrated by *Martini* and *Lentz* (1902) and others, had isolated both *Shiga's* bacillus and some distinct bacilli of the group which gradually came to bear his name.