



Schematic representation of *Escherichia coli* showing key structural elements including the flagella, which is the source of H antigen, and cell wall which is the source of somatic O antigen.

Salmonella Typing

by Peter C. Iwen, M.S.

Nomenclature

The salmonellae are a heterogeneous group of bacteria in the genus *Salmonella* of the family *Enterobacteriaceae*. The taxonomy and nomenclature of *Salmonella* have changed over the years and are still evolving. Currently, the CDC recognizes **two species** which are divided into **seven subspecies**: *S. enterica* (six subspecies) and *S. bongori* (one subspecies). The subspecies are divided into over **50 serogroups** based on somatic (O) antigens present. The serogroups are further divided into over **2300 serotypes** based on flagellar (H) antigens. The CDC now recommends that all organisms identified as *Salmonella* be reported by genus and serotype (or serogroup) omitting the reference to species. *Salmonella* serotypes are recognized with antigenic formulas listed in the document called the Kauffmann-White Scheme. Updating this scheme is the responsibility of the WHO Collaborating Centre for Reference and Research on *Salmonella*, which is located at the Pasteur Institute, Paris, France. Most *Salmonella* serotypes isolated from humans and warm-blooded animals belong to

Salmonella enterica subspecies 1 in Oserogroups

A, B, C1, C2, D, E1, E2,

E3, and E4. Additionally, a majority of

the isolates reported in the West North Central Region of the United States (Iowa, Kansas, Minnesota, Nebraska, North Dakota, and South Dakota) during 1996, were one of five serotypes included in O-serogroups B, C1, C2, or D1. It is impractical for most laboratories to perform even a limited typing of *Salmonella* because of the large number of reagents required. The NPHL offers testing available to confirm the most common serogroups in our region.

Salmonella serogroup

Bacterial identification systems, such as the Vitek™, API™, and MicroScan™, are reliable in the biochemical identification of *Salmonella* to the genus level. These systems however, do not identify the salmonellae into serogroups or serotypes. To identify *Salmonella* serogroups, numerous O-grouping antisera along with control antigens, are necessary. The NPHL has antisera to perform agglutination testing and recognize the following O-serogroups: Groups A, B, C1, C2, D, and E. In addition, antiserum to detect the capsular or virulence (Vi) antigen is also available to screen for *Salmonella* serotype (Group D). At the NPHL, serogrouping is routinely performed on all biochemically recognized salmonellae for confirmation and reporting.

Salmonella serotype

Typing of *Salmonella* for specific identification into serotypes requires an assortment of antisera such as single factor O-antisera as well as phase 1 and phase 2 H-typing antisera. In 1996, the most common *Salmonella* serotypes reported from the West North Central Region of the U.S. in descending order were ***Salmonella* serotype Enteritidis (Group D1)**, ***Salmonella* serotype Typhimurium (Group B)**, ***Salmonella* serotype Heidelberg (Group B)**, ***Salmonella* serotype Newport (Group C2)**, and ***Salmonella* serotype Braenderup (Group C1)**. These serotypes accounted for more than 75%

of the isolates reported from this region. The NPHL is developing protocols to identify these common serotypes when epidemiological investigations are warranted. Susceptibility testing is also available to detect multidrug resistant *Salmonella* serotype Typhimurium Definitive Type 104 (DT104). This isolate shows resistance to ampicillin, chloramphenicol, sulfonamides, streptomycin, and tetracycline, but generally is sensitive to trimethoprim and fluoroquinolones. Isolates submitted to NPHL which require additional typing are sent to the CDC for specific serotyping.

Conclusion

For epidemiological purposes, the NPHL has available reagents necessary to confirm and serogroup most isolates of *Salmonella* suspected throughout our region. Clinical laboratories are encouraged to submit all isolates of *Salmonella* to the NPHL for typing. This testing is performed without charge and the only requirement for submission of the isolate is completion of the "Special Microbiology Requisition Form". For more information on the typing of *Salmonella* at the NPHL,