

## AHL LabNote Number 35

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## Making sense of Salmonella spp. serotyping results

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At the Animal Health Laboratory (AHL), all clinical *Salmonella* isolates are sent for serotyping to OIE Salmonella reference Laboratory (SRL) because of public health concerns. As a rule of thumb, if *Salmonella* spp. are isolated from multiple samples from the same farm, their colony morphology is examined. If they look similar, only one colony is selected for serotyping. If morphology differs, multiple colonies are sent. *Salmonella* isolates are sent to OIE SRL every Wednesday and it usually takes **6-8 weeks** to receive serotyping results back.

Salmonella taxonomy underwent a major overhaul in 2005 when Salmonella enterica and Salmonella bongori (formerly group V) were established as the only 2 species of salmonellas. At the same time, it was recognized that the S. enterica group is comprised of 6 subspecies:

- 1. Salmonella enterica subsp. enterica (group I)
- 2. Salmonella enterica subsp. salamae (group II)
- 3. Salmonella enterica subsp. arizonae (group IIIa)
- 4. Salmonella enterica subsp. diarizonae (group IIIb)
- 5. Salmonella enterica subsp. houtenae (group IV)
- 6. Salmonella enterica subsp. indica (group VI)

Differentiation of *Salmonella* species and subspecies is relatively straightforward and it can be done biochemically. However, within each *Salmonella* subspecies, isolates can be further divided into different serotypes. Serotyping of salmonellas is based on immunological detection of 2 groups of cell surface antigens: lipopolysaccharides (O antigens) and flagellin proteins (H antigens). Moreover, H antigens in salmonellas are usually expressed as phase 1 and phase 2 antigens, a feature unique to *Salmonella* sp. As a result, each *Salmonella* enterica serotype has a specific antigenic formula shown as a combination of letters and numbers. This formula consists of subspecies designation (i.e., I, II, IIIa, IIIb, IV, VI), O antigens (i.e., a number or combination of numbers), phase 1 (i.e., lower case letter), and phase 2 flagellin (i.e., lower case letter or combination of numbers) antigens (Fig. 1). When all of the antigens are detected for a specific serotype of group I salmonellas, then that serotype is reported by a name. For example, *Salmonella* enterica subsp. enterica will be reported as serotype Typhimurium only if the following antigens are detected: S. I 4,5,12:i:1,2 (Fig.1). If any of these antigens are not detected, then that particular isolate will be reported by its antigenic formula only (e.g., S. I 4,5,12:i:-). In contrast to group I salmonellas, serotypes belonging to groups II through VI are always reported by their antigenic formulas only (e.g., S. IIIa 51:z4,z23:-).

## Salmonella Typhimurium

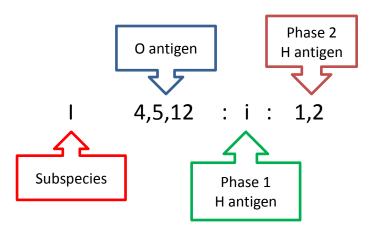


Fig. 1. Antigen designation in Salmonella sp. serotyping scheme.

To translate this into a practical perspective when you are looking into *Salmonella* serotyping results - if there is a name reported, it means that this particular serotype belongs to group I and that all antigens defining that serotype were detected. If there is an antigenic formula only, the first thing that one needs to look at is the subspecies designation. If there is a subspecies designation from II through VI, the full serotype is reported and there is not much additional information to be inferred from the results. However, if an antigenic formula for subspecies I is reported, in some cases more information can be gathered including **serotype variants**. A variant that we most frequently see in the lab is a **monophasic S. Typhimurium** with antigenic formula **S. I 4,5,12:i:-.** This antigenic formula defines a variant of *S.* Typhimurium missing a phase 2 H antigen. Some other variants of *S.* Typhimurium are shown in Table 1.

Table 1. Variants of S. Typhimurium and their antigenic formulas.

Designation	Antigenic formula
Monophasic	S. I 4,5,12:i:-
Nonmotile	S. I 4,5,12:nonmotile
Rough	S. I rough:i:1,2

**These variants should be treated the same as their parent serotypes.** Ensure that you notify clients of their zoonotic potential.

If you need any **additional information** about *Salmonella* spp. antigenic formula reported please feel free to **contact the lab**.