

***Francisella tularensis* subsp. *tularensis*,
Strain SCHU S4 Δ *clpB*/ Δ *wbtC***

Catalog No. NR-56771

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Contributor:

National Institutes of Allergy and Infectious Diseases (NIAID),
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Manufacturer:

BEI Resources

Product Description:

Bacteria Classification: *Francisellaceae*, *Francisella*

Species: *Francisella tularensis* subsp. *tularensis*

Biotype/Biovar: Type A

Strain: SCHU S4 Δ *clpB*/ Δ *wbtC*

Original Source: *Francisella tularensis* (*F. tularensis*) subsp. *tularensis*, strain SCHU S4 Δ *clpB*/ Δ *wbtC* is a double-deletion mutant of genes *clpB*, encoding a heat shock gene, and *wbtC*, encoding a UDP-glucose 4-epimerase, from *F. tularensis* subsp. *tularensis*, strain SCHU S4.^{1,2,3} Strain SCHU S4 is a clone of highly virulent strain SCHU, which was isolated in 1941 from a human case of tularemia in Ohio, USA.^{4,5}

Comments: *F. tularensis* subsp. *tularensis*, strain SCHU S4 Δ *clpB*/ Δ *wbtC* was generated using a suicide plasmid-based allelic exchange method targeting the *clpB* and *wbtC* genes.¹ Verification of the Δ *clpB* mutation by whole genome sequencing (WGS) analysis and demonstration of significant attenuation in culture confirms that NR-56770 conforms to the criteria listed for exclusion of *Francisella tularensis* subsp. *tularensis*, strain SCHU S4 Δ *clpB* from the requirements of 42 CFR part 73, i.e., the Select Agent guidelines, and is suitable for use in BSL2 laboratories. The complete genome of *F. tularensis* subsp. *tularensis*, strain SCHU S4 has been sequenced (GenBank: [AJ749949.2](https://www.ncbi.nlm.nih.gov/nuccore/AJ749949.2)).

F. tularensis subsp. *tularensis* is a small, non-motile, aerobic, pleomorphic, Gram-negative coccobacillus which displays the highest degree of human virulence among *F. tularensis* subspecies. The pathogenicity of *Francisella* is attributed to the Francisella Pathogenicity Island (FPI), a gene cluster encoding a type VI secretion system (T6SS) consisting of 17 proteins involved in the modulation of host-bacterial or bacterial-bacterial interactions.⁶ Deletion of *clpB*, located in the FPI gene cluster, has demonstrated compromised intracellular replication, attenuated virulence and impaired handling of stress stimuli in mutant strains compared to wild-type strains.⁶ *wbtC* possesses putative nicotinamide adenine dinucleotide (NAD)-binding domains important for dehydratase activities of *F. tularensis*, strain SCHU S4.³ Deletion of *wbtC* in strain strain SCHU S4 resulted in a highly attenuated mutant producing a long chain O-polysaccharide with altered chemical and electrophoretic characteristics.³

Material Provided:

Each vial contains approximately 0.5 mL of bacterial culture in Mueller-Hinton broth supplemented with 10% glycerol.

Note: If homogeneity is required for your intended use, please purify prior to initiating work.

Packaging/Storage:

NR-56771 was packaged aseptically in cryovials. The product is provided frozen and should be stored at -60°C or colder immediately upon arrival. For long-term storage, the vapor phase of a liquid nitrogen freezer is recommended. Freeze-thaw cycles should be avoided.

Growth Conditions:

Media:

Mueller Hinton broth or Cystine Heart broth with 5% defibrinated rabbit blood or equivalent
Chocolate agar with IsoVitaleX™ Enrichment (BD BBL™ B11875) or Cystine Heart agar with 5% defibrinated rabbit blood or equivalent

Incubation:

Temperature: 37°C
Atmosphere: Aerobic

Propagation:

1. Keep vial frozen until ready for use, then thaw.
2. Transfer the entire thawed aliquot into a single tube of broth.
3. Use several drops of the suspension to inoculate an agar slant and/or plate.
4. Incubate the tube, slant and/or plate at 37°C for 3 days.

Citation:

Acknowledgment for publications should read “The following reagent was obtained through BEI Resources, NIAID, NIH: *Francisella tularensis* subsp. *tularensis*, Strain SCHU S4 Δ *clpB*/ Δ *wbtC*, NR-56771.”

Biosafety Level: 2

Appropriate safety procedures should always be used with this material. Laboratory safety is discussed in the following publication: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. [Biosafety in Microbiological and Biomedical Laboratories \(BMBL\)](#). 6th ed. Washington, DC: U.S. Government Printing Office, 2020.

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References:

1. Conlan, J. W., et al. "Differential Ability of Novel Attenuated Targeted Deletion Mutants of *Francisella tularensis* Subspecies *tularensis* Strain SCHU S4 to Protect Mice Against Aerosol Challenge with Virulent Bacteria: Effects of Host Background and Route of Immunization." Vaccine 28 (2010): 1824-1831. PubMed: 20018266.
2. De Pascalis, R., et al. "Working Correlates of Protection Predict SchuS4-Derived-Vaccine Candidates with Improved Efficacy against an Intracellular Bacterium, *Francisella tularensis*." NPJ Vaccines 7 (2022): 95. PubMed: 35977964.
3. Twine, S. M., et al. "Roles for *wbtC*, *wbtI*, and *kdtA* Genes in Lipopolysaccharide Biosynthesis, Protein Glycosylation, Virulence, and Immunogenicity in *Francisella tularensis* Strain SCHU S4." Pathogens 1 (2012): 12-29. PubMed: 25152813.
4. Hesselbrock, W. and L. Foshay. "The Morphology of Bacterium Tularensis." J. Bacteriol. 49 (1945): 209-231. PubMed: 16560913.
5. Eigelsbach, H. T., W. Braun and R. D. Herring. "Studies on the Variation of Bacterium Tularensis." J. Bacteriol. 61 (1951): 557-569. PubMed: 14832199.
6. Alam, A., et al. "CipB Mutants of *Francisella tularensis* Subspecies *holarctica* and *tularensis* Are Defective for Type VI Secretion and Intracellular Replication." Sci. Rep. 8 (2018): 11324. PubMed: 30054549.

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