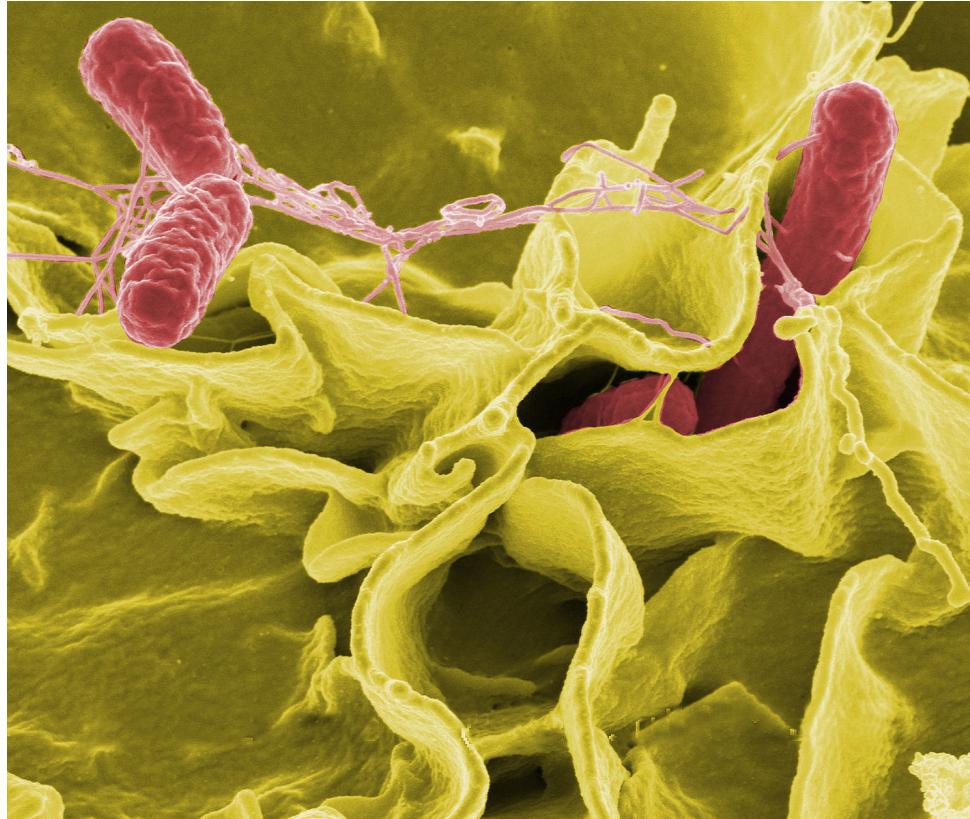


Salmonella Pathogenicity Genes



Credit: Rocky Mountain Laboratories, NIAID, NIH
<https://commons.wikimedia.org/wiki/File:SalmonellaNIAID.jpg>

joanne.pratt@olin.edu



True or False?

- At least half of the cells in your body are bacterial, not human
- Some bacteria can hide *inside* your cells
- If you have E. coli in your body, you'd feel very sick
- If you have Salmonella in your body, you'd feel very sick
- Diseases caused by bacteria can be cured by antibiotics
- Handwashing can save lives

True or False?

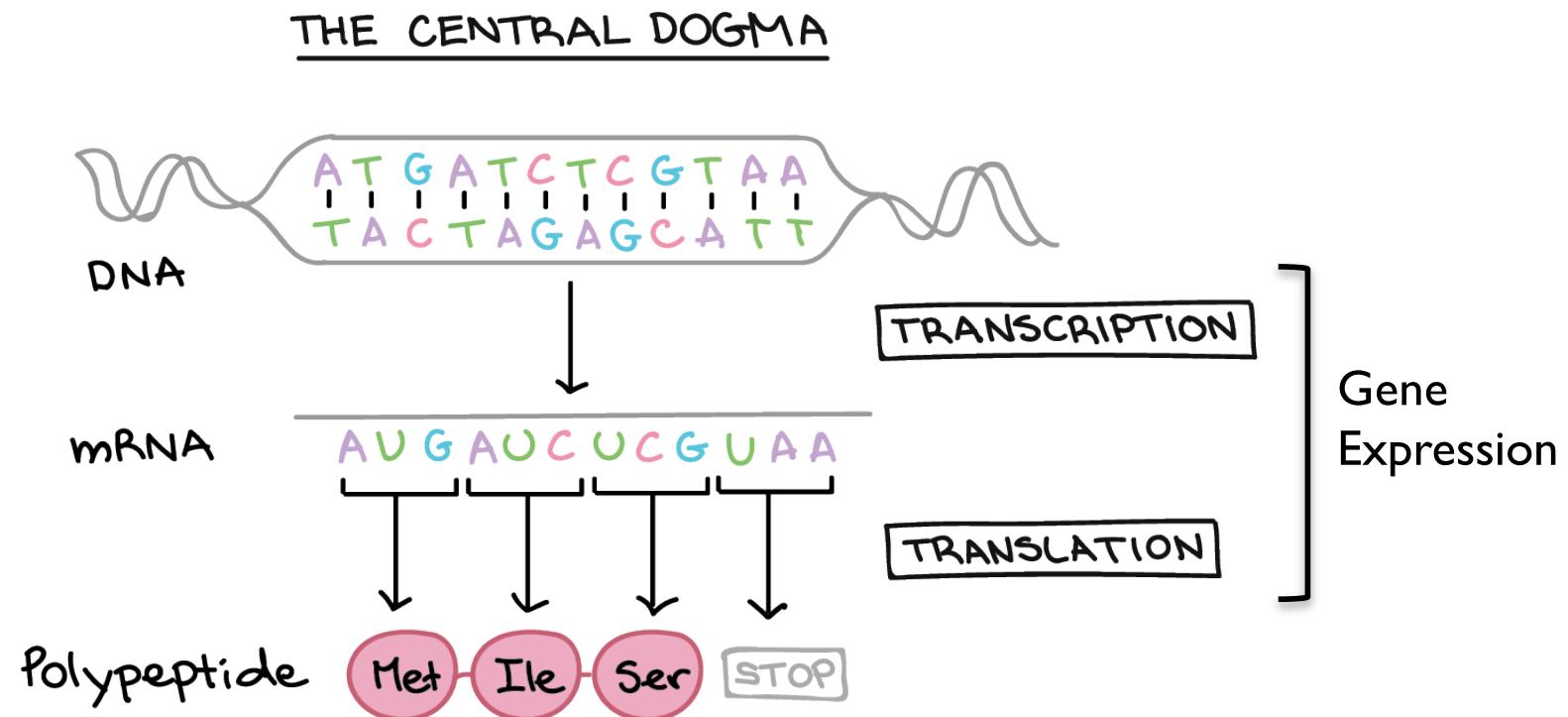
- At least half of the cells in your body are bacteria
- Some of those bacteria are beneficial to our cells
- If you eat a healthy diet, there are more good bacteria in your body than bad bacteria
- Hand washing is important to remove bad bacteria from your body



Image: https://en.wikipedia.org/wiki/Mary_Mallon

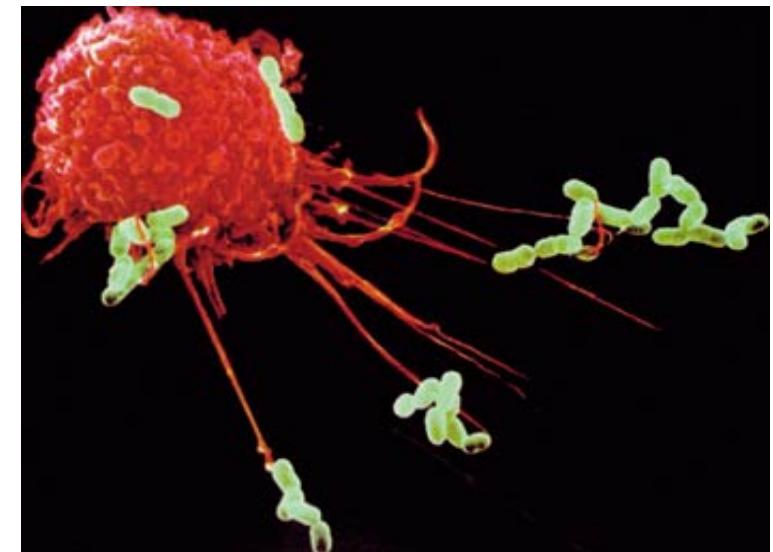
Central Dogma of Molecular Biology

(aka DNA makes RNA makes Protein)



What do Salmonella need to do to survive?

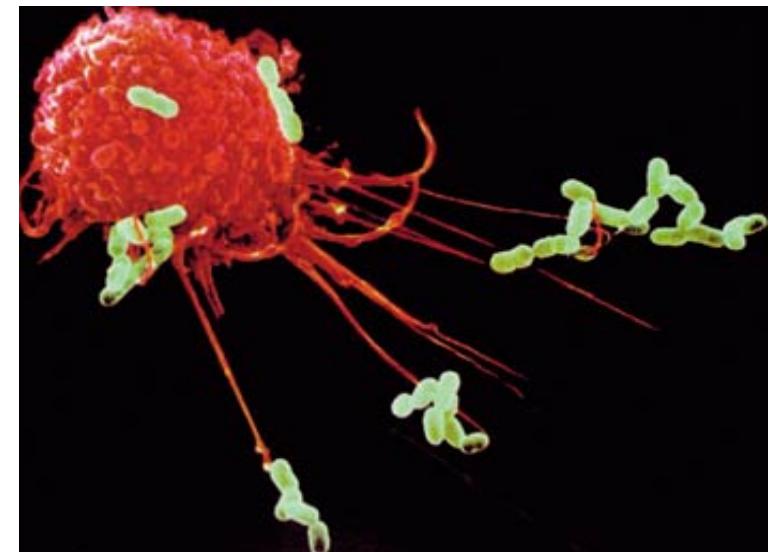
- Get inside your body
- Survive the stomach environment
- Get inside cells
- Avoid the immune system
- Acquire nutrients
- Reproduce



<http://m.harunyahya.com/tr/Books/3752/The-Miracle-In-The-Cell/chapter/4966/The-Cell-Membrane>

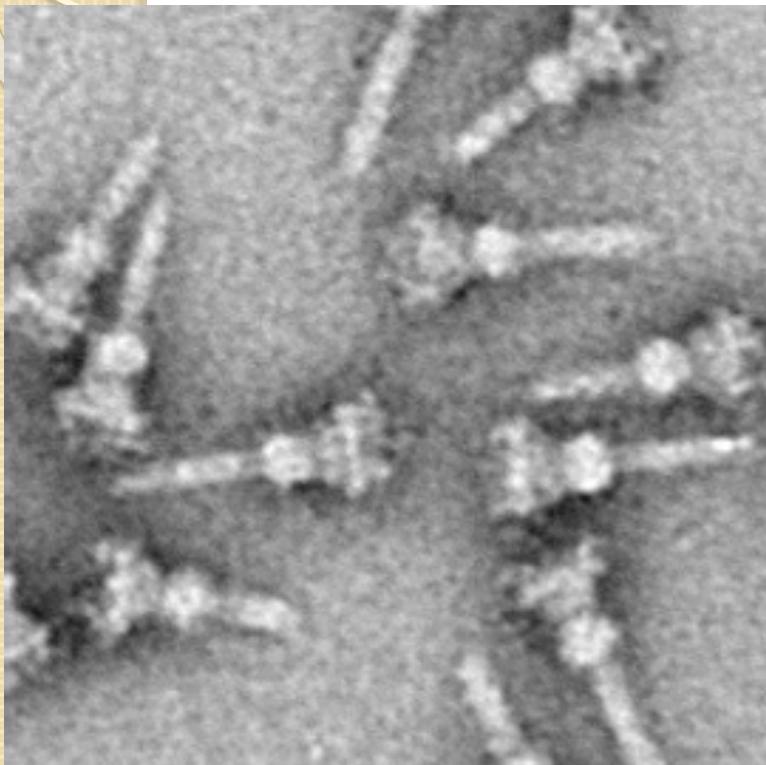
What do Salmonella need to do to survive?

- Get inside your body
- Survive the stomach environment
- **Get inside cells**
- Avoid the immune system
- Acquire nutrients
- Reproduce



<http://m.harunyahya.com/tr/Books/3752/The-Miracle-In-The-Cell/chapter/4966/The-Cell-Membrane>

Transmission EM and schematic of T3SS



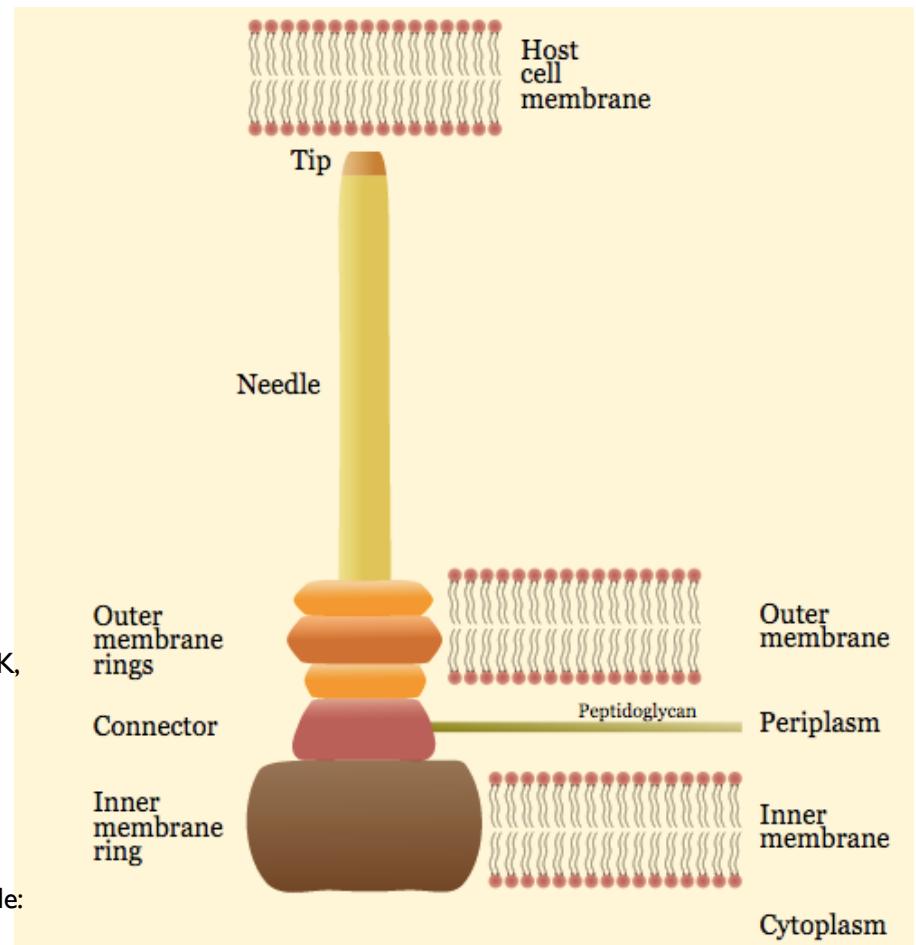
Transmission EM credit:

Schraadt O, Lefebre MD, Brunner MJ, Schmied WH, Schmidt A, Radics J, Mechtler K, Galán JE, Marlovits TC - Cropped image from Schraadt et al. (2010), Topology and Organization of the *Salmonella typhimurium* Type III Secretion Needle Complex Components. PLoS Pathog 6(4): e1000824. doi:10.1371/journal.ppat.1000824

Schematic of complex

"T3SS needle complex" by Pixie - Own work. Licensed under CC BY-SA 3.0 via Wikimedia Commons -

http://commons.wikimedia.org/wiki/File:T3SS_needle_complex.svg#mediaviewer/File:T3SS_needle_complex.svg



Interpreting Blast: bacteria classifications

Salmonella species: enterica and bongori

subspecies, serovar, serotype (cell surface proteins)

- Typhi, Typhimurium, Enteritidis, Newport, Javiana, Heidelberg

strain, subtype

- DT2, O8-1736, U288



Interpreting Blast: virulence sequences and protein names

- **Salmonella Pathogenicity Islands (SPI's)**
 - Regions of DNA where several genes essential for virulence are clustered
- **Type (I, II, III) Secretion Systems (ex.T3SS)**
 - Protein Groups associated with virulence
- **Fimbriae, Chaperone, ATP synthase, Protein tyrosine kinase,ABC Transporter**
 - Examples of proteins associated with virulence
- **GAP, PTP, PTK**
 - Examples of protein domains



Protein Blast

Basic Local Alignment Search Tool

BLAST finds regions of similarity between biological sequences. The program compares nucleotide or protein sequences to sequence databases and calculates the statistical significance.

[Learn more](#)

NEWS

Understanding BLAST+ parameters

Having a basic understanding of BLAST+ parameters is essential to getting the results that meet your needs.

Mon, 28 Jan 2019 17:00:00 EST

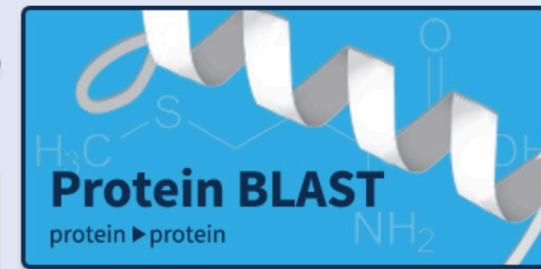
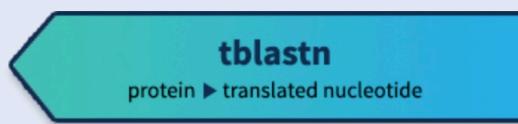
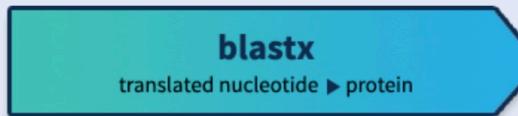
[More BLAST news...](#)

Web BLAST



Nucleotide BLAST

nucleotide ▶ nucleotide



Protein BLAST

protein ▶ protein

surface presentation of antigens, partial [Salmonella enterica subsp. enterica serovar Typhimurium]

GenBank: CAA51921.1

[Identical Proteins](#) [FASTA](#) [Graphics](#)



Your turn to Blast

Mystery sequence I:

You haven't been feeling well lately, and your doctor takes a few cells from you for full genome sequence analysis. In addition to your human cells, the doctor also finds the unknown mystery sequence I. Should you be concerned about this finding?

Mystery sequence II:

You want to learn more about your ancestry, and you have your DNA sequenced. You get the result of one of your genes, but it isn't immediately clear what it tells you about your ancestry. Google the gene name (after Blasting to get the name) to see if there is a hint about your ancestry.

Protein Structure: Protein Data Bank

PDB PROTEIN DATA BANK 148586 Biological Macromolecular Structures Enabling Breakthroughs in Research and Education

Search by PDB ID, author, macromolecule, sequence, or ligands **Go**

Advanced Search | Browse by Annotations

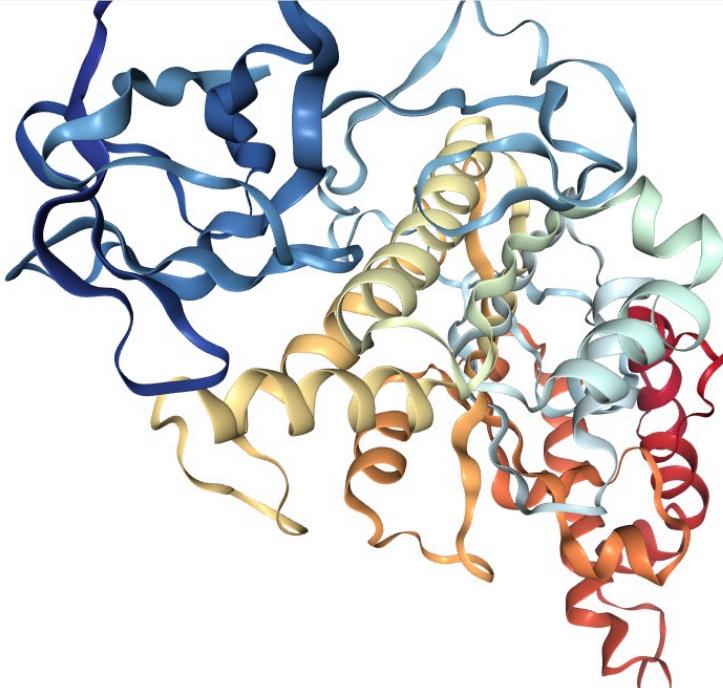
PDB-101 Worldwide Protein Data Bank EMDDataBank Nucleic Acid Database Worldwide Protein Data Bank Foundation

Structure Summary 3D View Annotations Sequence Sequence Similarity Structure Similarity Experiment

2DPY

Crystal structure of the flagellar type III ATPase FliI

Note: Use your mouse to drag, rotate, and zoom in and out of the structure. Mouse-over to identify atoms and bonds. [Mouse controls documentation.](#)



Display Files Download Files

Structure View Electron Density Maps

Ligand View

Structure View Documentation

Assembly Bioassembly

Model Model 1

Symmetry None

Style Cartoon

Color Rainbow

Ligand Ball & Stick

Quality Automatic

Water Ions

Hydrogens Clashes

Default Structure View

Spin Center Fullscreen Screenshot Perspective Camera

Salmonella virulence factors affect normal cellular pathways and functions



KEGG - Table of Contents



Sources for protein information

- Protein Blast to find related protein sequences (possibly with already known functions)
- Protein Data Bank for structural information
- Kegg database for intracellular pathway information
- PubMed/Google scholar articles for studies published on the protein



Questions?

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