



Modern microbiology methods for Food Safety

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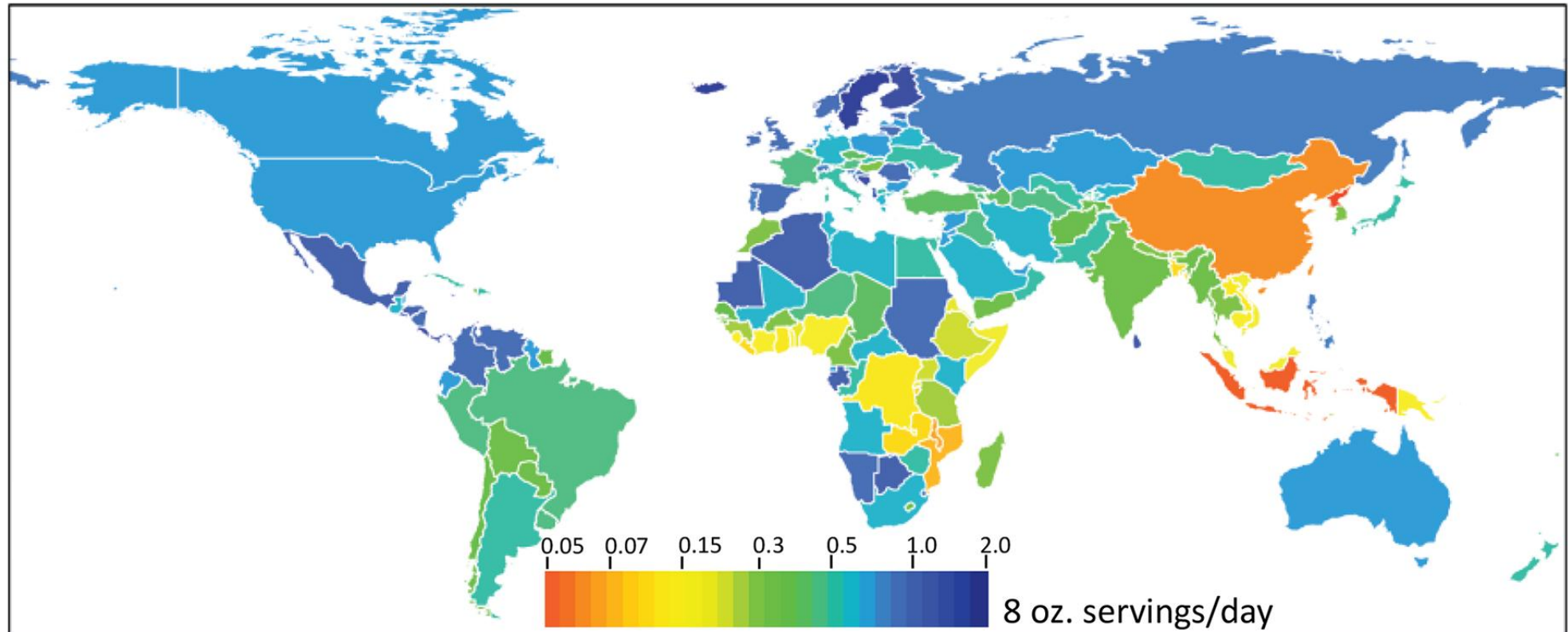
Dairy in numbers

549M metric tons of milk were produced worldwide in 2023

Humans drink 2.2 billion liters of milk per day

80% of humans regularly include dairy in their diets

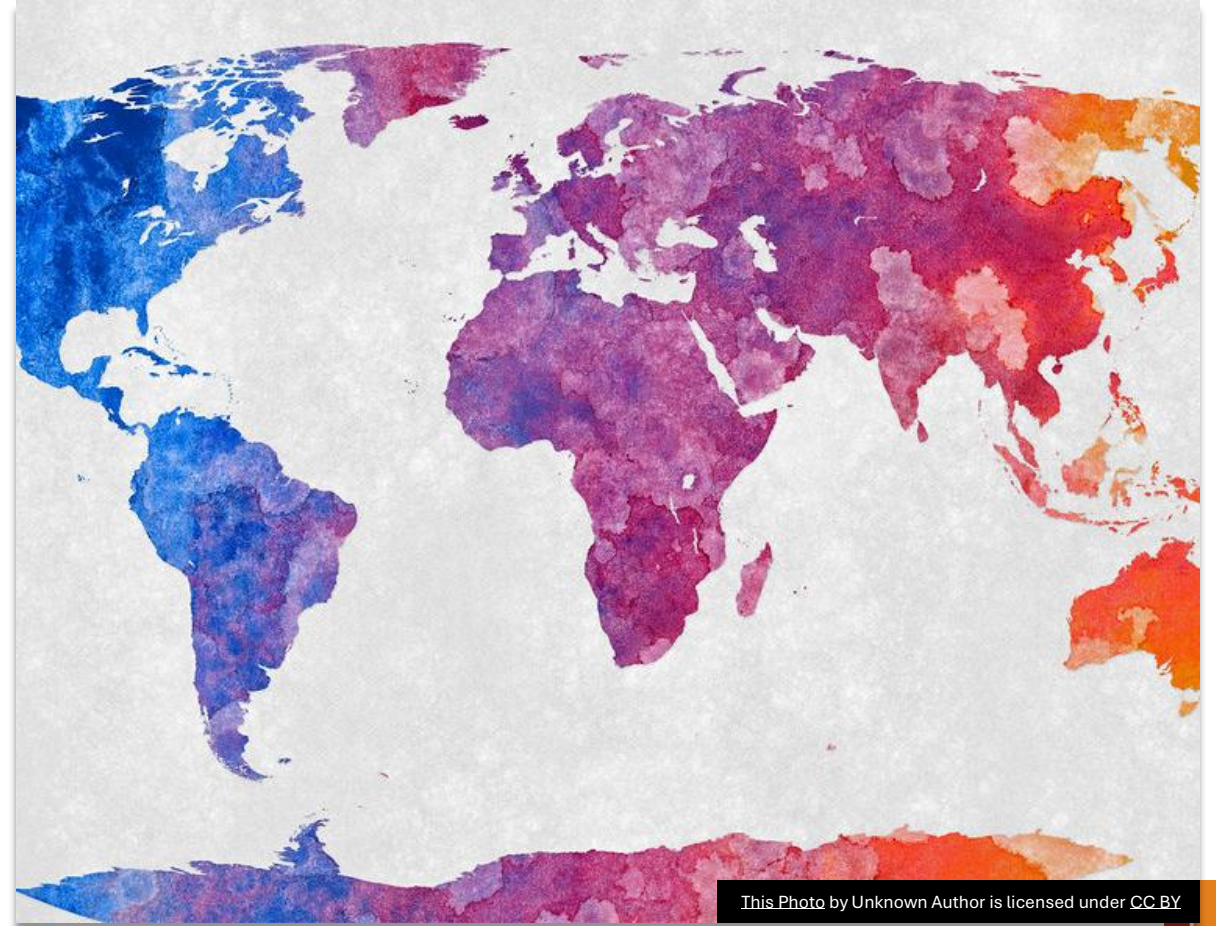
<https://worldwithoutcows.com/a-table-for-10-billion-the-role-of-dairy-in-global-food-security-and-sustainability/>



Food Safety Globaly

WHO estimates that each year:

- 600 million people get sick
- 420,000 die of foodborne diseases



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Food Safety in US

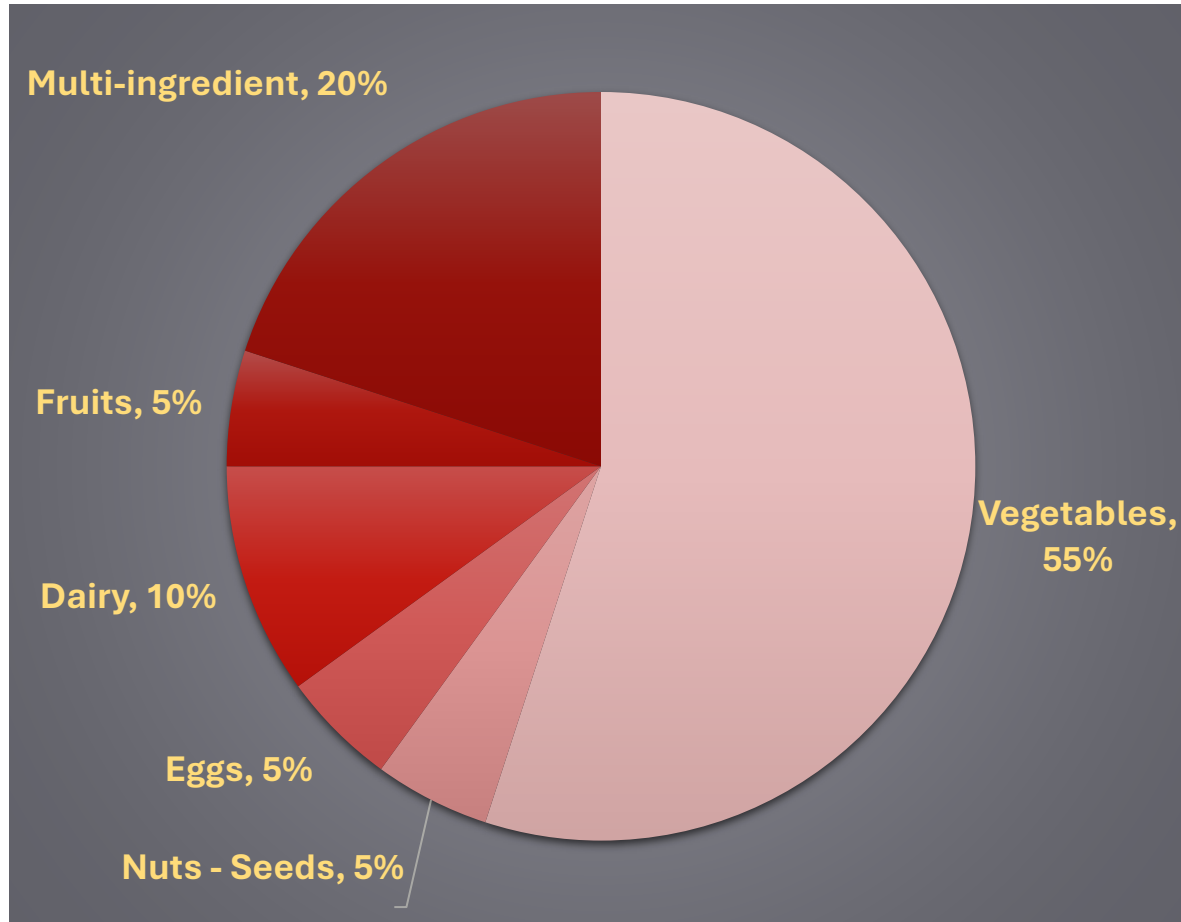
CDC estimates that each year:

- 48 million people get sick
- 128,000 hospitalizations
- 3,000 deaths attributed to foodborne diseases

<https://www.cdc.gov/food-safety/data-research/facts-stats/index.html>

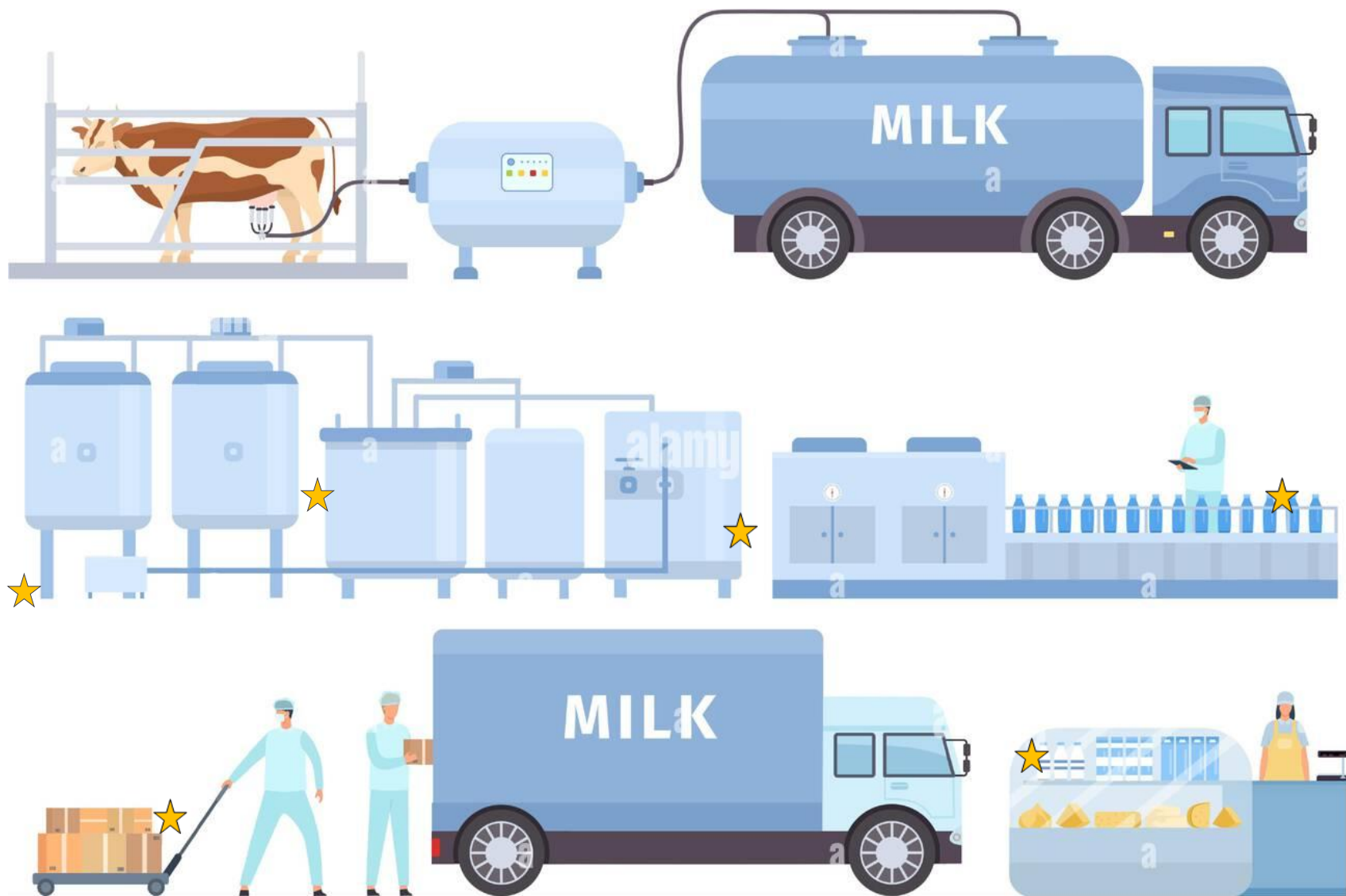


How is dairy doing in Food Safety?



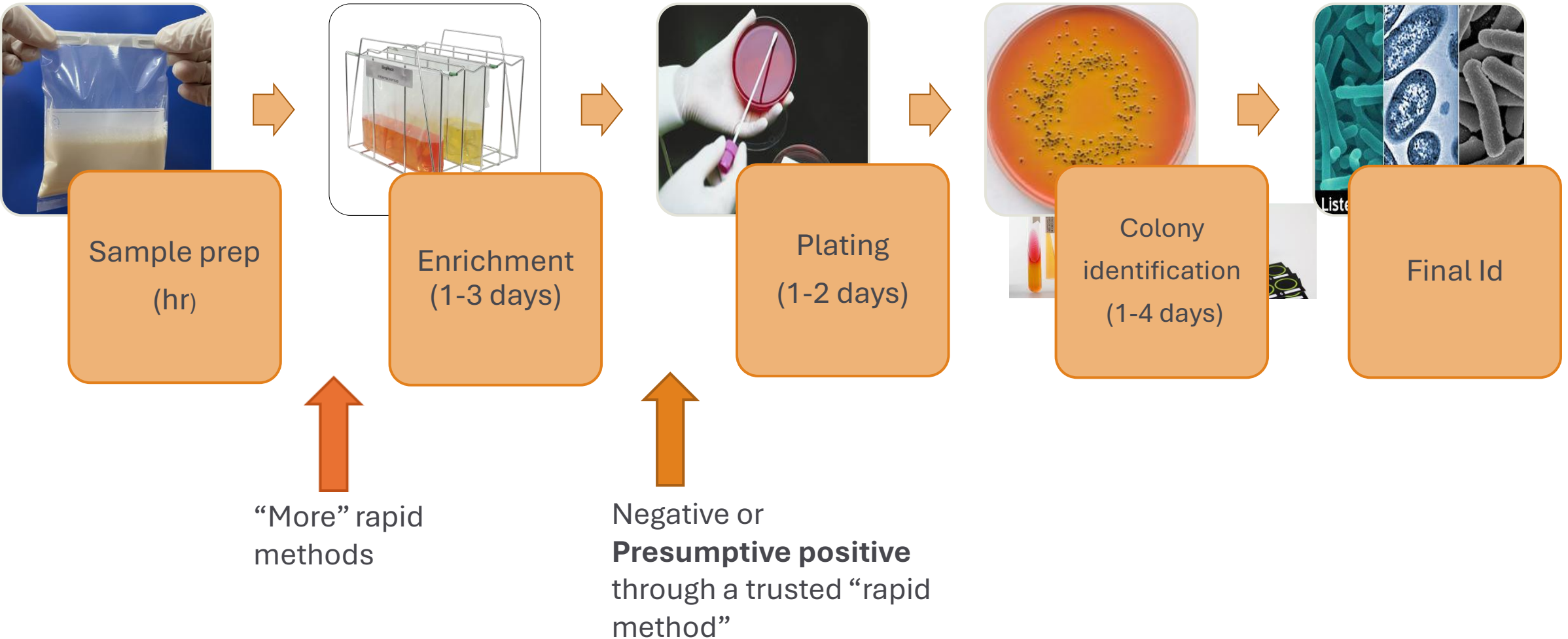
<https://www.fda.gov/food/outbreaks-foodborne-illness/core-2024-annual-report>

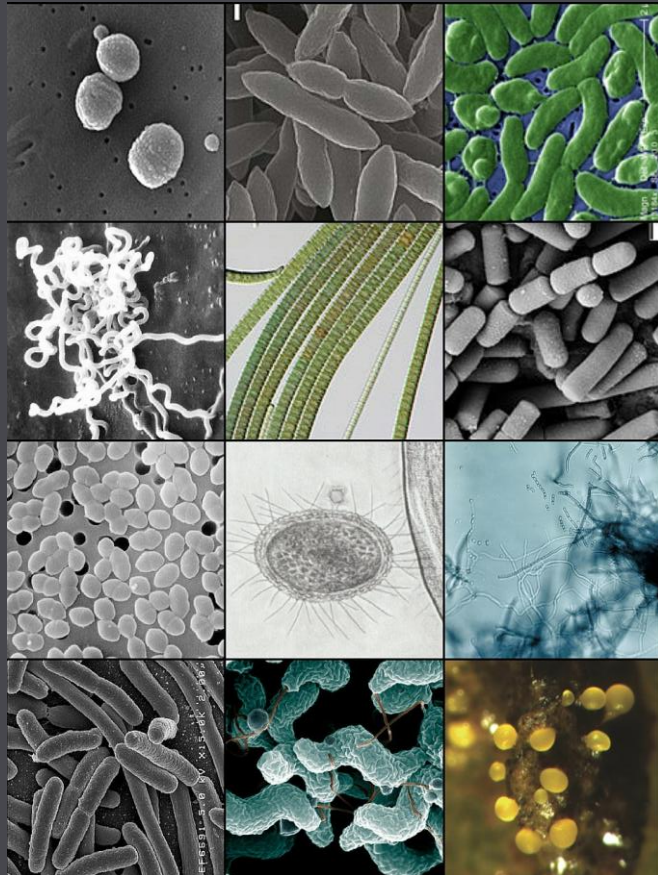




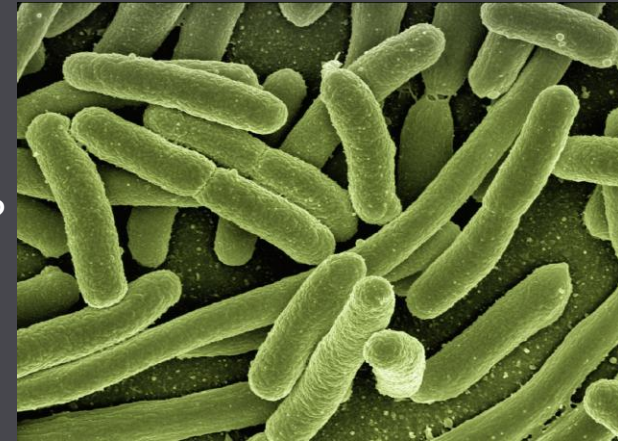
★ Test for
pathogenic
bacteria

Food pathogen testing





Are all Salmonellas identical?



Are all Humans identical?



Listeria, Salmonella, Staphylococcus,
Clostridium, Cronobacter...

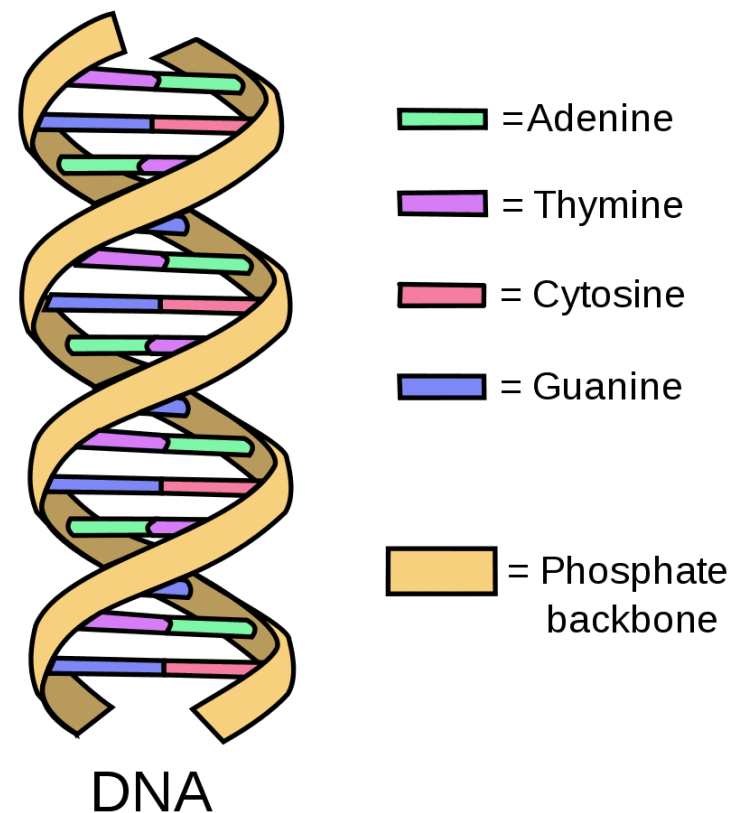




Genomics

What is genomics?

- **Genome:** the whole hereditary information of an organism that is encoded in the DNA
- **Genomics:** the study of structure, function, evolution, and mapping of genomes.



How can we use genomics?



All organisms have unique DNA sequence



Determining the DNA sequence of an organisms is the tool used to distinguish “individuals”



Importance of DNA sequence in bacteria

Number of DNA bases in *Listeria* genome:

3,011,203

Single point mutations in *inlA* gene of *Listeria monocytogenes* reduces its ability to cause diseases

Number of letters in the Bible:

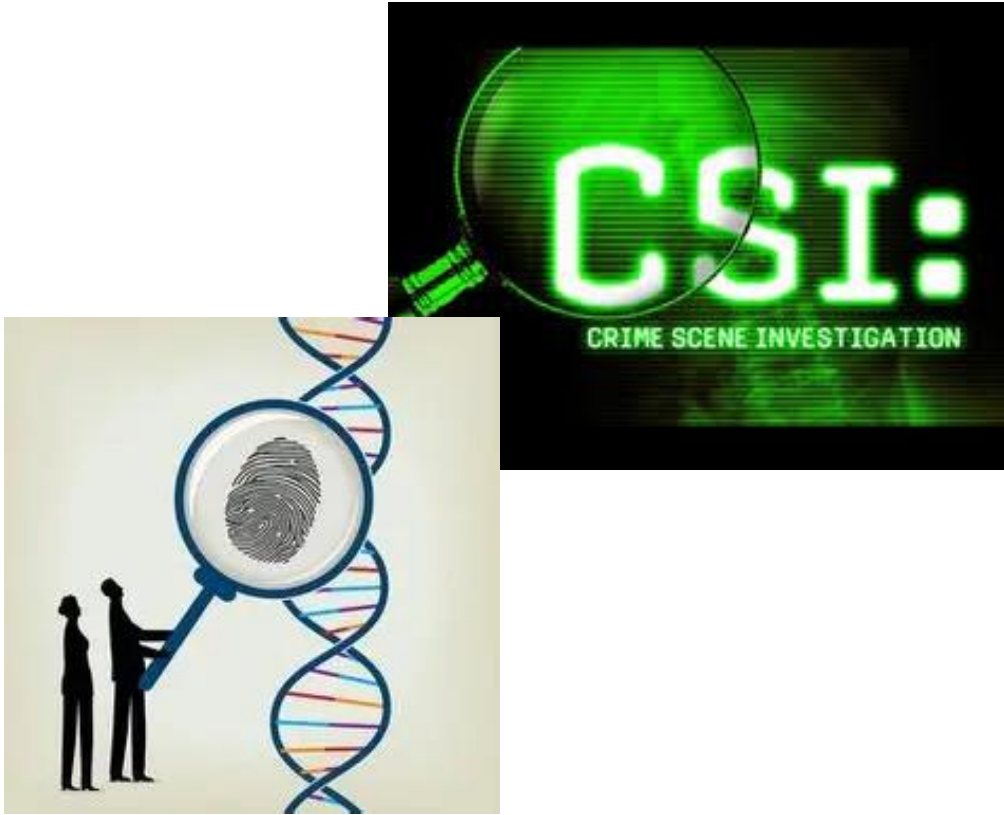
3,116,480

In some copies of the Bible the word “not” was accidentally omitted from the commandment “Thou shalt not commit adultery.”

Three little letters can make a huge difference in meaning!



Genomics use in crime investigations



- Identifying human remains
- Comparing DNA sequence to databases
- Predicting physical characteristics
- Follow individuals

Genomics in Food safety investigations



Tracking source of microbial contamination



Differentiate between new and recurrent strains in production environments



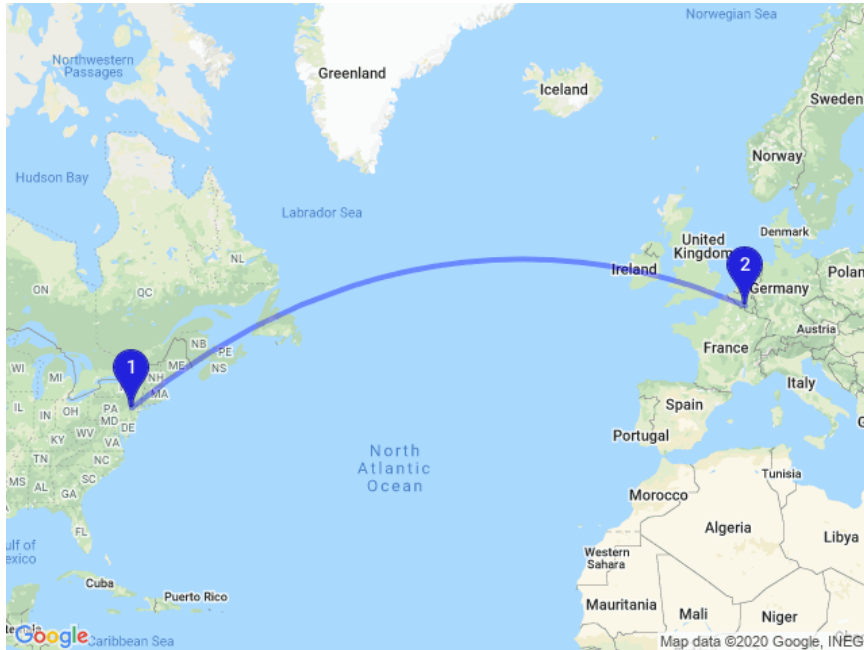
Predicting traits like virulence, antimicrobial resistance, resistance to environment



Unexpected source of bacterial contamination



Unexpected source of bacterial contamination





Thank you!

Any questions?