

Genomic insights and virulence in soil-persistent *E. coli*

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Outline



Background

Our work

Classification

Assessing Virulence

Pangenome Analysis

In conclusion

Background

A Brief History of Soil-persistent *E. coli*



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- 1886 . . . ● Escherich: Discovery of *E. coli*
 - 1948 . . . ● Soil may act as reservoir for *E. coli* [Bardsley]
 - 1963 . . . ● Cold persistence observed [W. and J. Boyd]
 - 1988 . . . ● Alternative indicators suggested [Fujioka and Shizumura]
 - 1995 . . . ● Soil persistence across time and depth [R. Sjogren]
 - 2003 . . . ● Soil persistence is widespread [Byappanahalli, et al]
 - 2010 . . . ● Persistence in maritime temperate soils [Brennan, et al]
-

Our work

Research Questions



- What types of *E. coli* are able to persist in soil?

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- o What virulence factors are harboured by these strains?

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- What types of *E. coli* are able to persist in soil?
- What virulence factors are harboured by these strains?
- What can we infer about adaptation from these?
- Can we differentiate soil-persistent *E. coli* from recent contamination?

The data

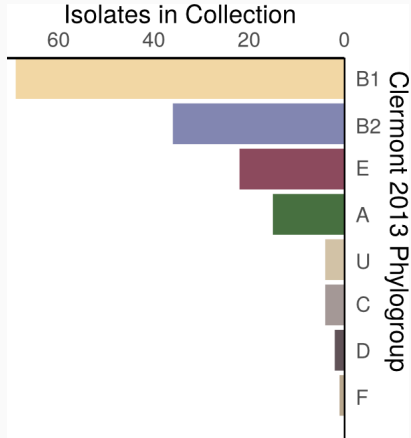


- o 171 isolates sequenced
- o 22 failed assembly QC or ANI threshold
- o 149 true *E. coli*

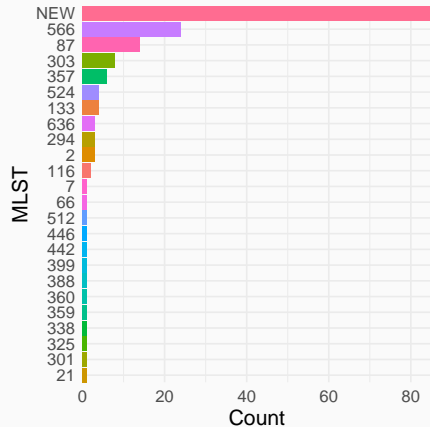
Classification

Sequence Typing

Clermont 2013



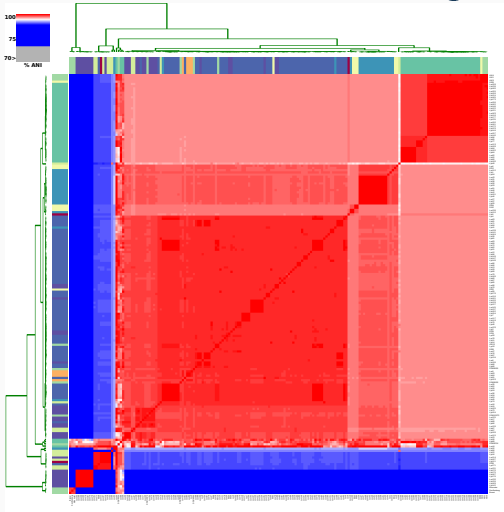
Achman 7 gene MLST



Average Nucleotide Identity



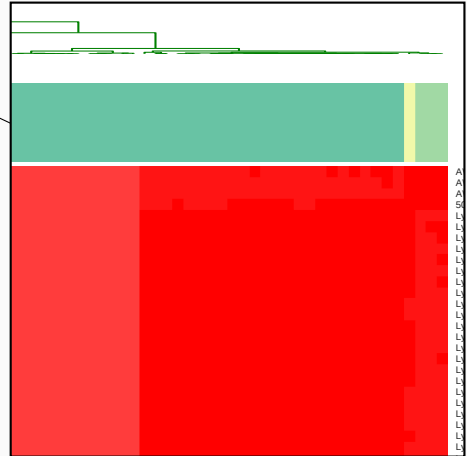
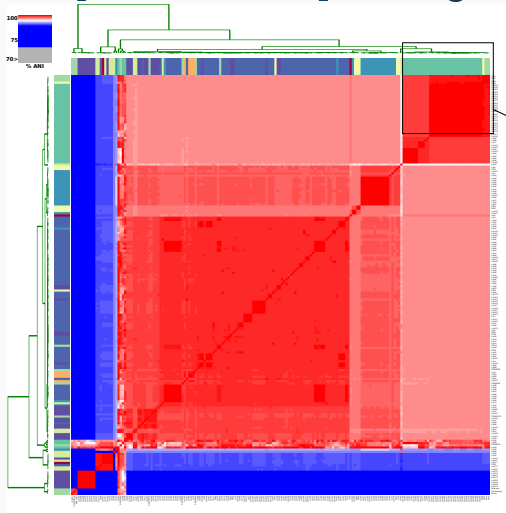
<http://widdowquinn.github.io/pyani/>



Average Nucleotide Identity



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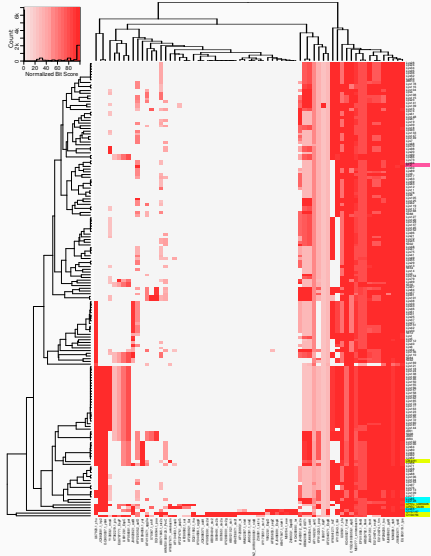


Assessing Virulence

Virulence Results

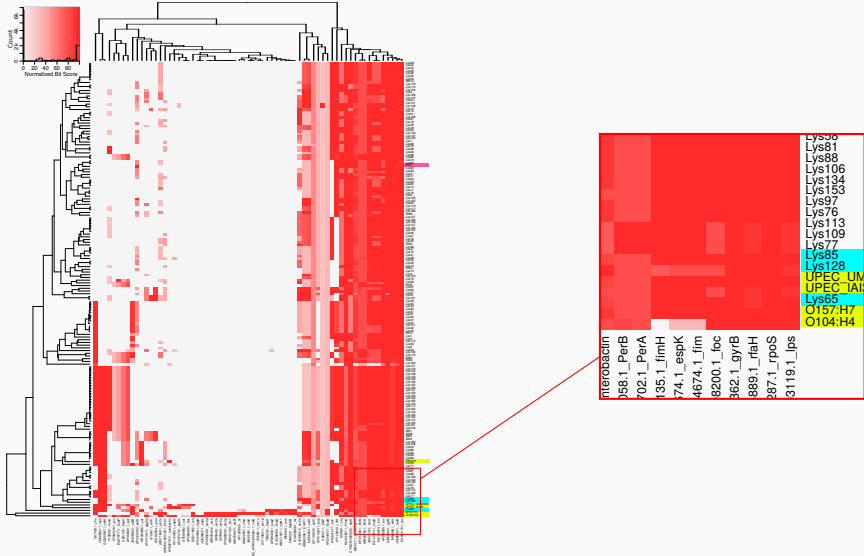


Virulence Results



- Select representative sequences for 65 virulence factors
- Use reciprocal translated blast to find occurrences
- Visualize filtered results

Virulence Results

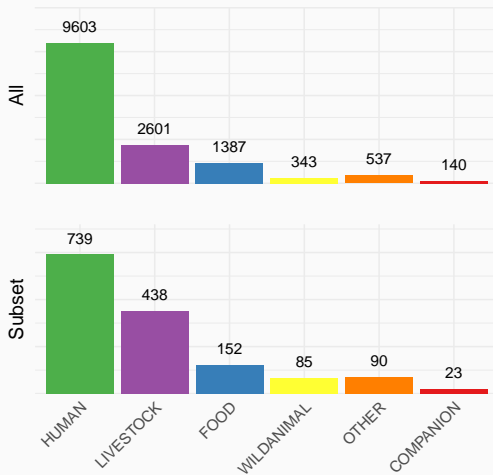


Pangenome Analysis

Enterobase comparison strains



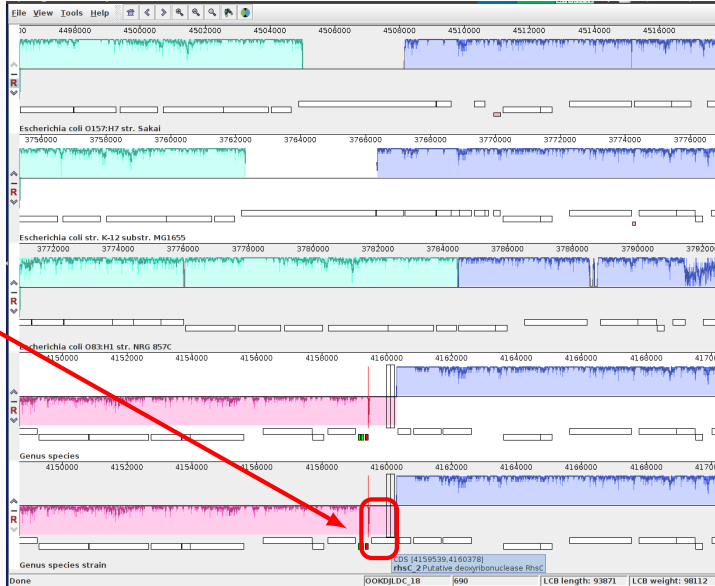
- One isolate from each
Achman 7 MLST
- Total: 1193



Assessing Assemblies

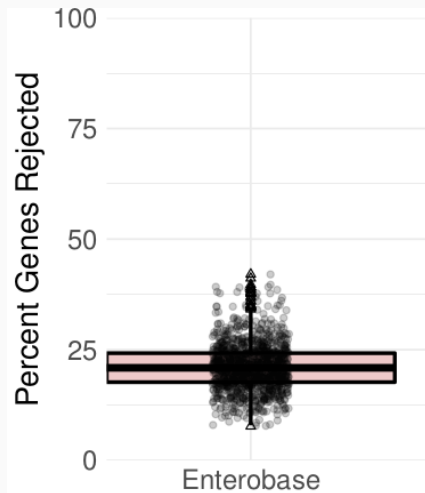
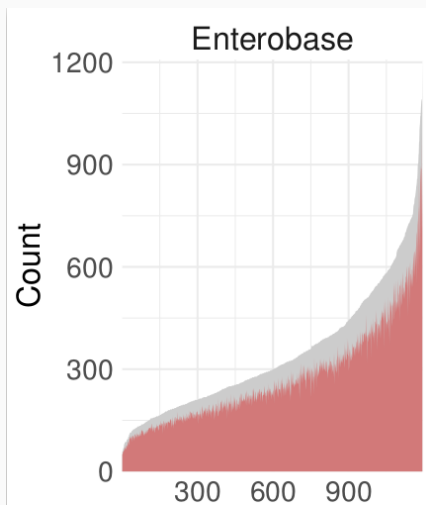


Partial



annofilt performance

<https://nickp60.github.io/annofilt/>



Pangenome Analysis



	N	Core	total
Soil	149	2662	21,662
Enterobase	1193	1822	79,288
All	1342	1806	83,868

Detecting differential presence/absence



- Statistically compare traits to a pangenome



In conclusion

Future work



- Subpangenomes
- Virulence pathways
- AMR
- Mobile elements

Conclusions



- Soil *E. coli* represent diverse lineages
- Soil *E. coli* possess a range of virulence genes
- Pangenome analysis is very sensitive to annotation

Interested in Genome Assembly?



Come ask about our tool **riboSeed** to assemble through rDNA repeats!

- o Poster 466 zone D (upper gallery)
- o Tuesday and Wednesday Evening

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AGE BA IAL ARCHITE
ER
riboSeed
LEVER AGE BACT ER IAL ARCHITE CTURE

Acknowledgments



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NUIG Microbiology

- ☐ Dr. Fiona Brennan
- ☐ Dr. Florence Abram
- ☐ Soil and Environmental
Microbiology Research Group
- ☐ Functional Environmental
Microbiology Group



James Hutton Institute, Dundee

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Questions?