The Relationship between Virulence and Transport of *Listeria monocytogenes* in Saturated Sand Columns

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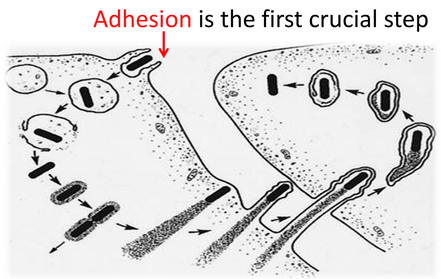
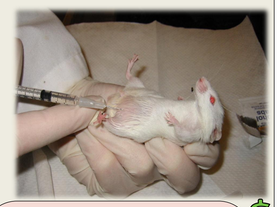


in the pathogenesis of *L. monocytogenes (1).*

Introduction

•*Listeria monocytogenes* is a Gram positive, intracellular, food-borne pathogens that may cause life-threatening infections in elderly or immunocompromized individuals and can also result in the abortion of fetuses .

•Strains of *L. monocytogenes* express a wide range of virulence factors. Virulence can be estimated by LD_{50}values. LD_{50} represents the lethal bacterial dose required to kill 50% of mice in an *in vivo* bioassay.



Not applied routinely due to highly demanding cost and labor

•*L. monocytogenes* are soil microbes and their mobility through sand is considered to play a vital role in their dispersal. Their abilities to transfer in soil can be evaluated by their collision efficiency, a measurement of the retention of the bacteria during transport in saturated porous media.

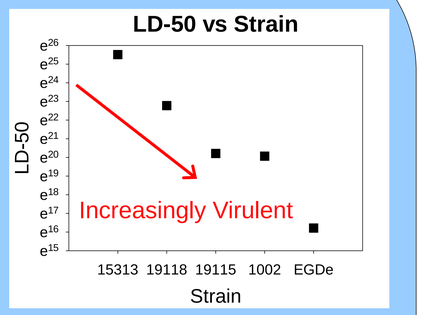
Materials and Methods

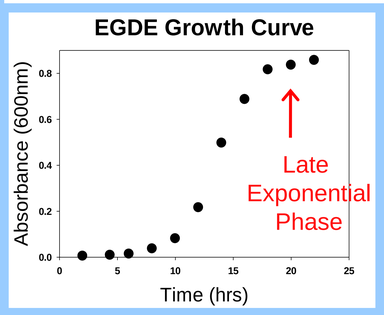
•Five *L. monocytogenes* strains were grown for 12 hours at 25^{0}C and 150 RPM in 5 mL brain heart infusion broth (BHIB) and then subcultered to 125 mL BHIB and grown at the same conditions for 12 hours.

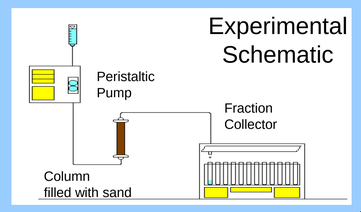
•The cells were isolated at the late exponential phase of their growth.

•The culture was centrifuged at 5100 RPM for 10 minutes and washed to resuspended the cells in deionized water to an absorbance of 0.5 A_{600} .

•Cells were pumped through the packed sand column at a speed of 1.16 m/day and their absorbances were measured at 600nm every 16 seconds.







Goals

Quantify the collision efficiencies of the seven strains

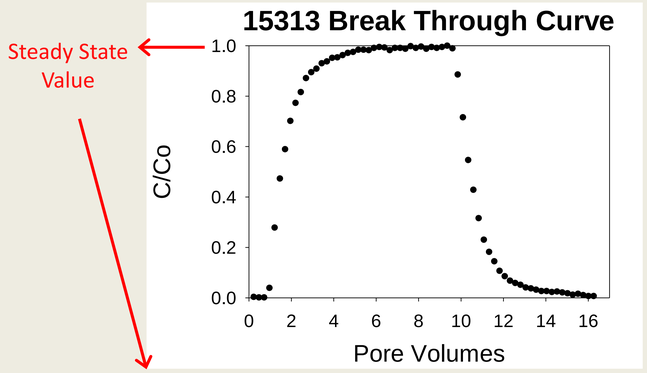
Correlate *L. monocytogenes* retention in sand to the varying pathogenicity of the isolates

Hypothesis

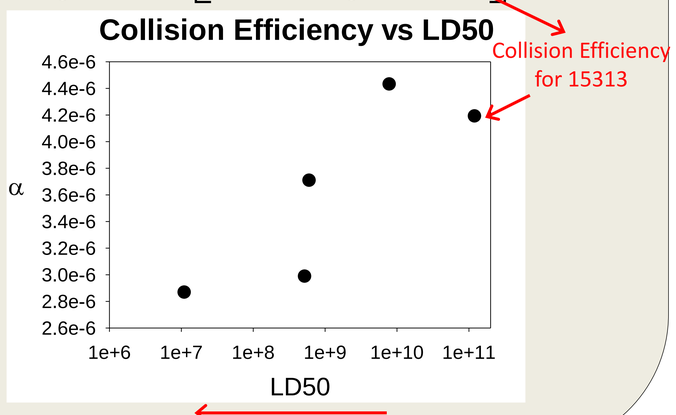
Increasingly virulent strains of *L. monocytogenes* demonstrate higher adherence to sand during advective transport.

Results

Break Through Curves were analyzed at steady state with Yao model filtration equation to calculate the collision efficiency to plot against the strain's LD_{50} value.



$$\frac{C}{C_o} = \exp\left[-\frac{3}{2}\frac{(1-\theta)}{d_c}\alpha\eta L\right]$$



Conclusion

Our results indicate that the collision efficiency and the LD_{50} of each strain are logarithmically correlated according to:

$$\alpha = 7.53\times10^{-8} + 1.6999\times10^{-7}\cdot\ln(LD50\#)$$

Such correlation indicates that collision efficiency could potentially be used as a design criterion to distinguish between virulent and nonpathogenetic *L. monocytogenes* strains.

Stronger adhesion of non-virulent strains to inert surfaces modeled by sand suggests these strains have an innate advantage to their persistence within soil.

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References

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