Health, Diseases, and Medicine

Microbes in Health & Disease Research

Microbial Diversity & Ecology

Dr. Brian Hedlund
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School of Life Sciences
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Expertise

- Microbial diversity exploration
- Cultivation of recalcitrant microorganisms
- Systems biology

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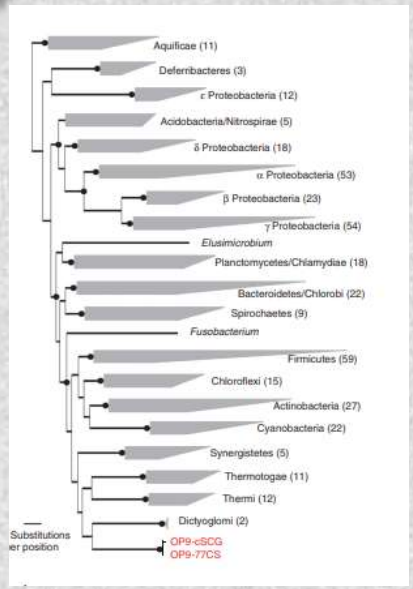
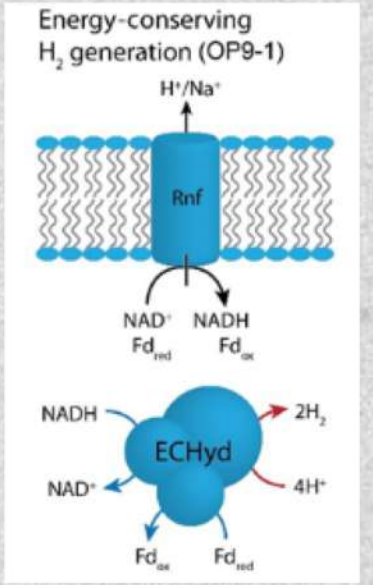
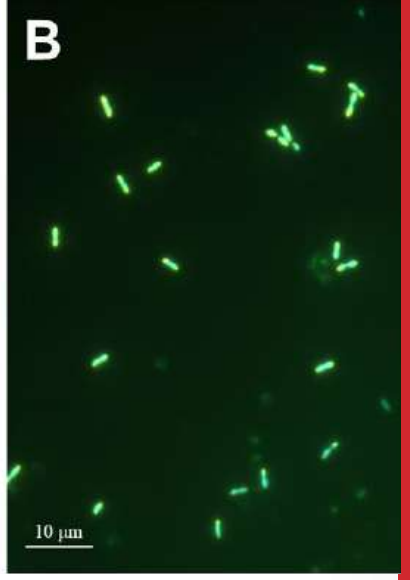
Exploring microbiology's "dark matter"

- Environmental genomics
- Genome-enabled cultivation
- Transcriptomics, proteomics, metabolomics
- Stable-isotope experiments







Big questions

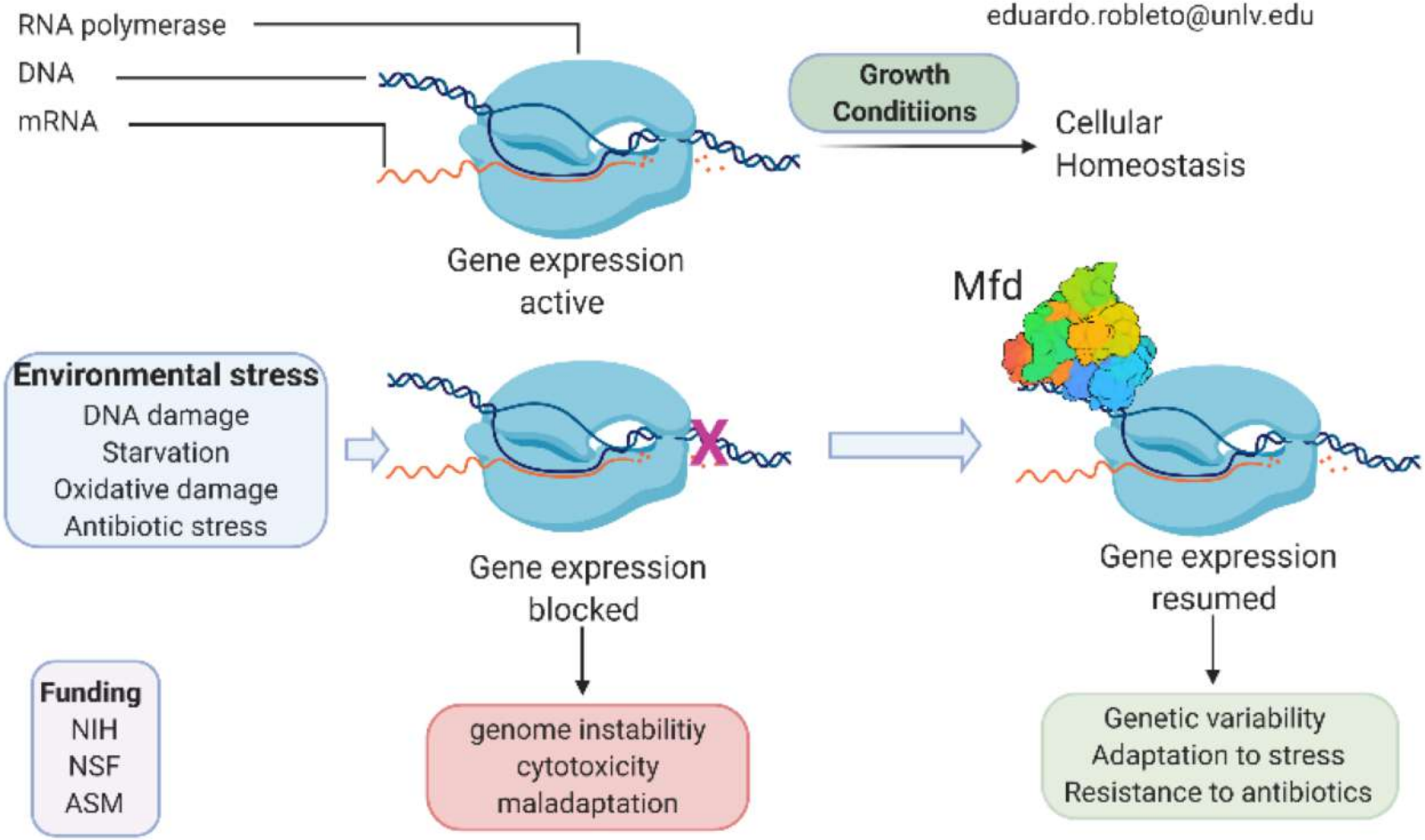
- What is the function of billions-year-old microbial lineages that have never been cultivated in any lab? Why have they rebuked microbiologists for centuries?
- How can we organize and communicate microbial diversity effectively?
- How does thermal stress affect biology?
- How can we use microbial diversity to solve human problems?

https://hedlund.faculty.unlv.edu/

Bacterial Physiology and Evolution

The Robleto lab studies the effects of Mfd on bacterial cell physiology and evolution

Contact: Dr. Eduardo Robleto
Professor, School of Life Sciences
eduardo.robleto@unlv.edu



Funding
NIH
NSF
ASM

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Bacterial Physiology Research

Dr. Boo Shan Tseng
Assistant Professor
School of Life Sciences
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Expertise:

- *Pseudomonas aeruginosa*
- Biofilms
- Bacterial stress response
- Antimicrobial susceptibility
- Cystic fibrosis lung infections

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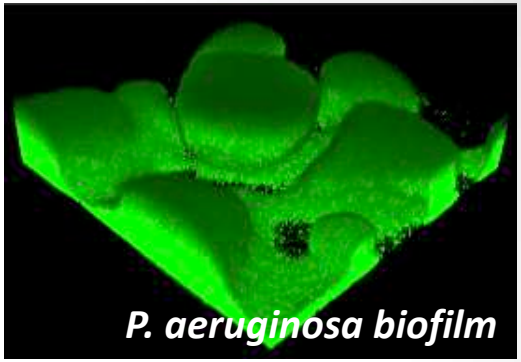
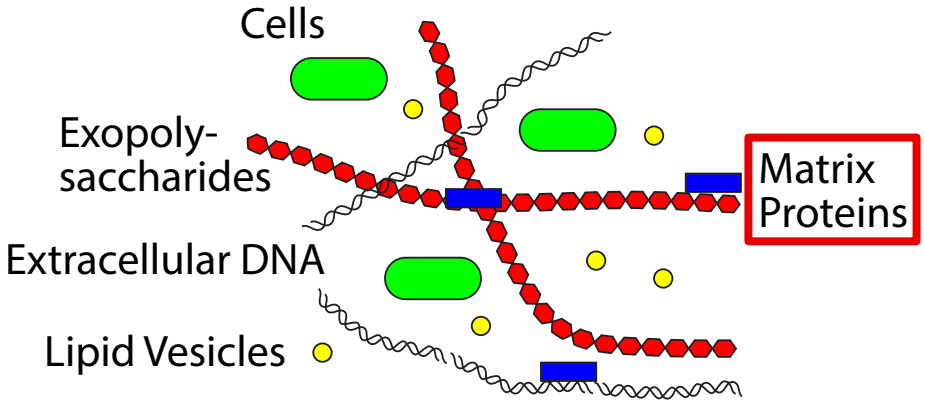
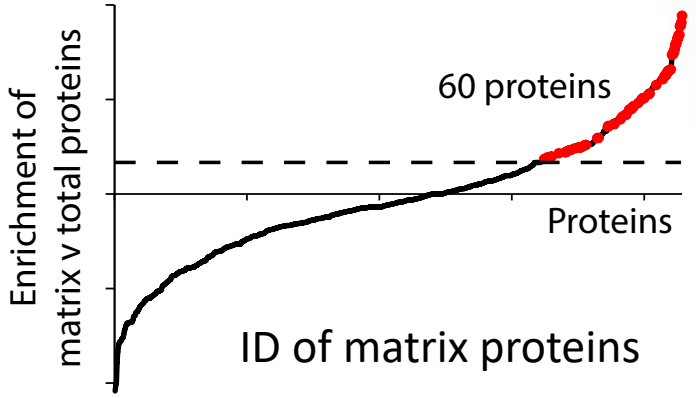
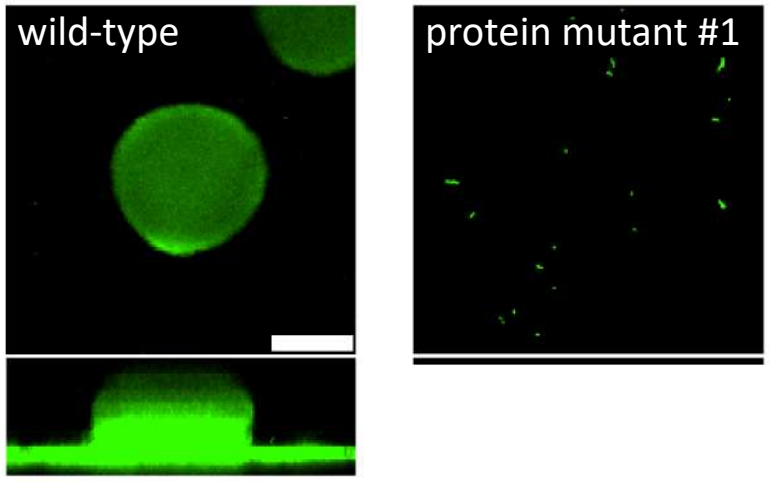
Identifying the roles of biofilm matrix components



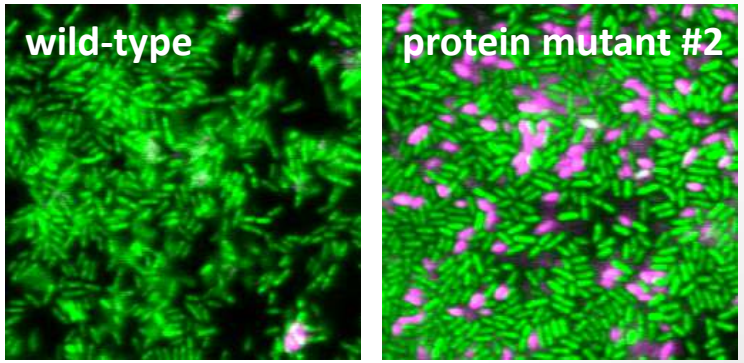




Functions in biofilm formation

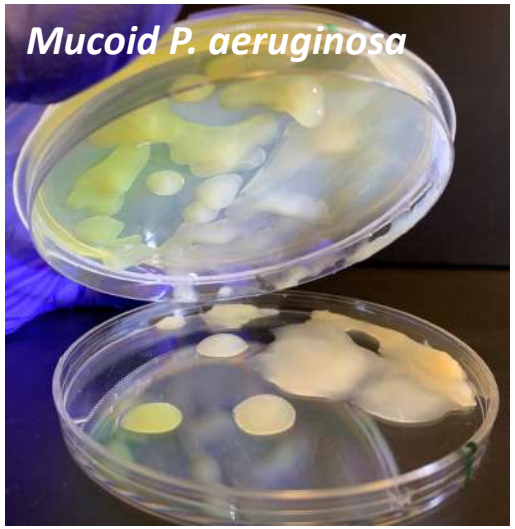


Functions in antimicrobial susceptibility

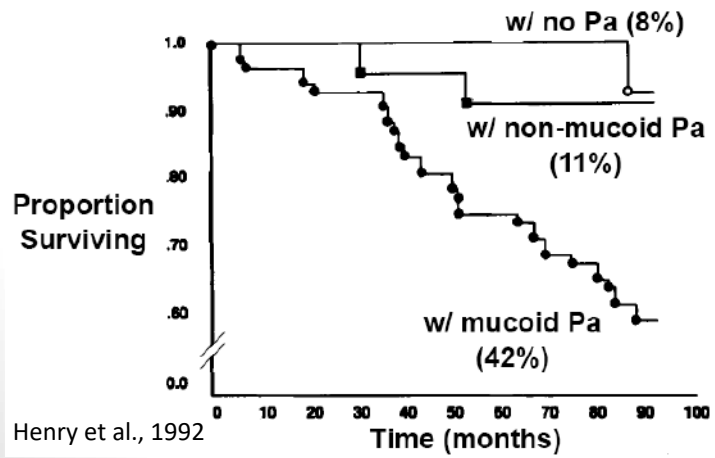


Treated with elastase (green: alive; purple: dead)

Mechanism behind the essentiality of bacterial envelope stress inhibitor

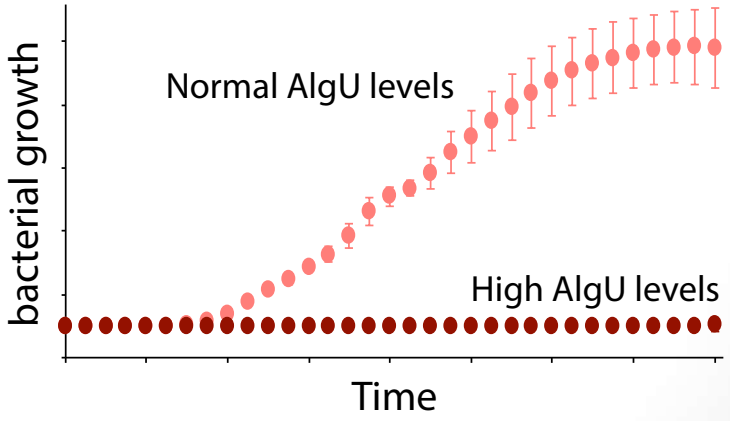


- Exopolysaccharide overproducing (e.g. mucoid) bacteria arise during chronic lung infection
- Associated with poor disease outcomes
- Due to mutation in *mucA* gene, which encodes for inhibitor of envelope stress response via AlgU
- BUT *mucA* required for bacterial viability and overproduction of AlgU inhibits growth



Henry et al., 1992

In children with cystic fibrosis



Question: why is a gene commonly mutated in clinical isolates required for bacterial viability?

Microbiology

Dr. Helen J. Wing
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Expertise

- Microbiology focusing on agents of Infectious Disease
- Bacterial Gene Regulation
- Bacterial Physiology
- Molecular Biology controlling virulence
- Identification of novel drug targets
- Antibiotics use & Antibiotic resistance

Genetic switches & molecular mechanisms controlling virulence

Central themes of this project

Transcriptional control of bacterial genes

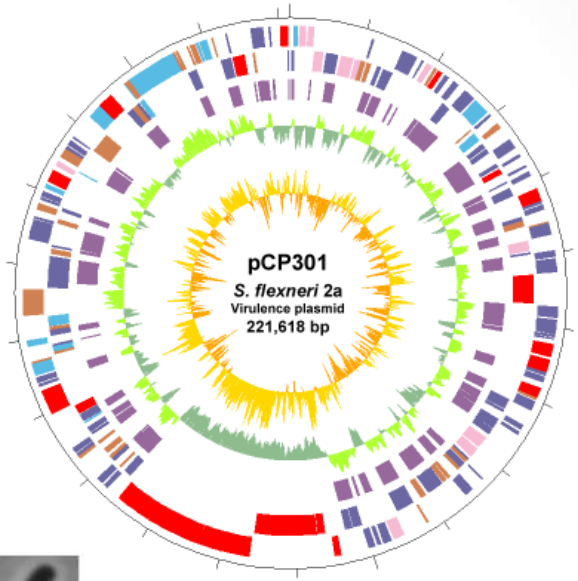
Dynamic nucleoid remodeling

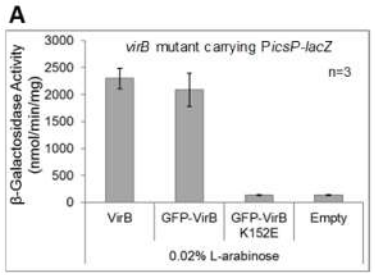
DNA-protein and ligand-protein interactions

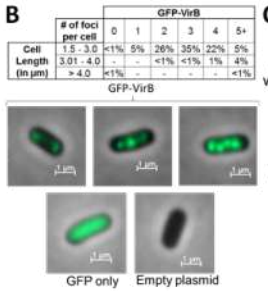
Evolutionary relationship of bacterial proteins

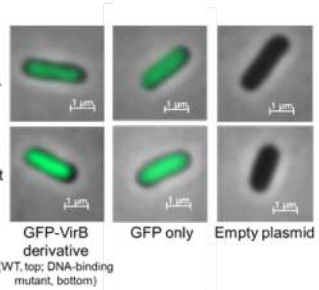
Bacterial management of large plasmids

Novel targets for antibiotics and therapeutics







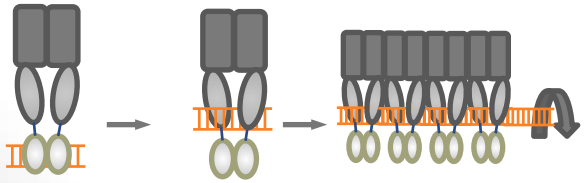


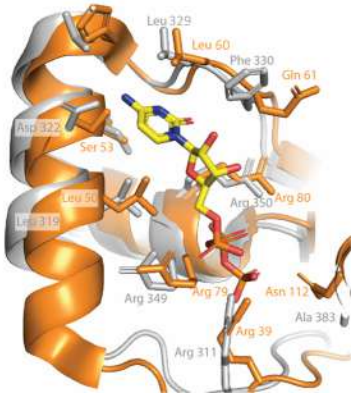
A: Current model

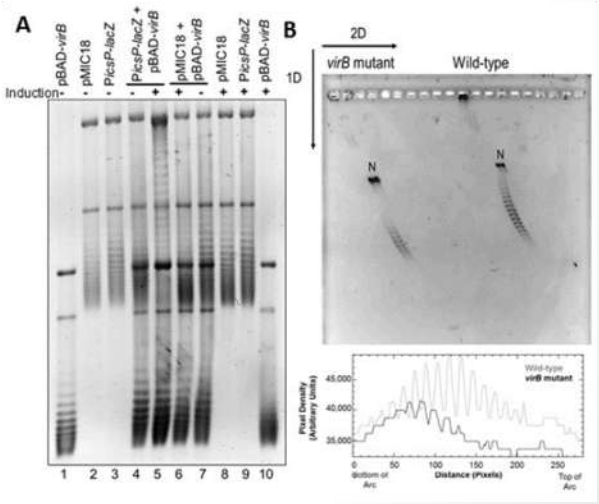
Step 1: Non-specific interactions with DNA (in vitro only)

Step 2: Binding to its recognition site is a prereq. for Δlk, focus formation & anti-silencing

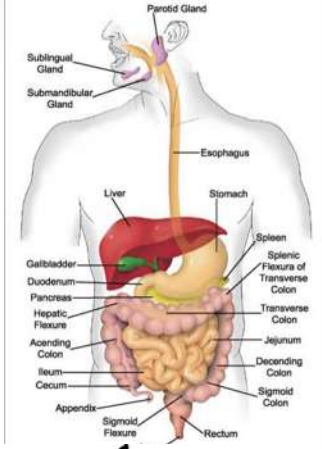
Step 3: Spreading along DNA causing torsion in the DNA helix. The triggered change in DNA supercoiling is sufficient to relieve gene silencing.







Shigella pathogenesis



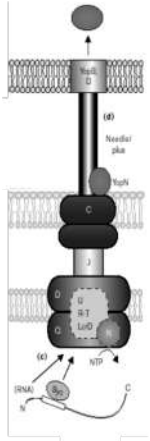
Fast Facts

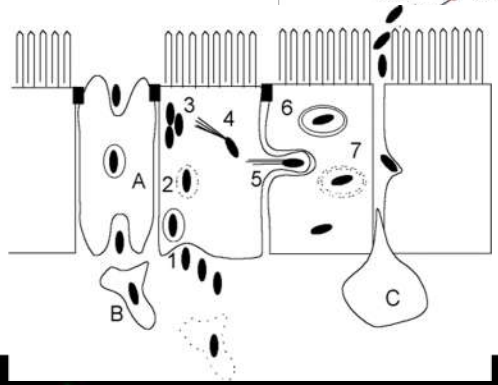
Shigella species - causal agents of bacillary dysentery

Cause an estimated 80-165 million cases per year and 600,000 deaths, mostly in children under 5 years.

Highly infectious (low infectious dose)

Increasingly resistant to commonly used antibiotics



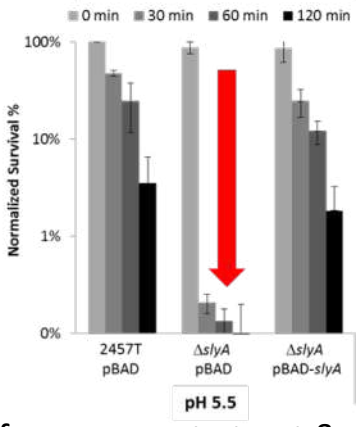


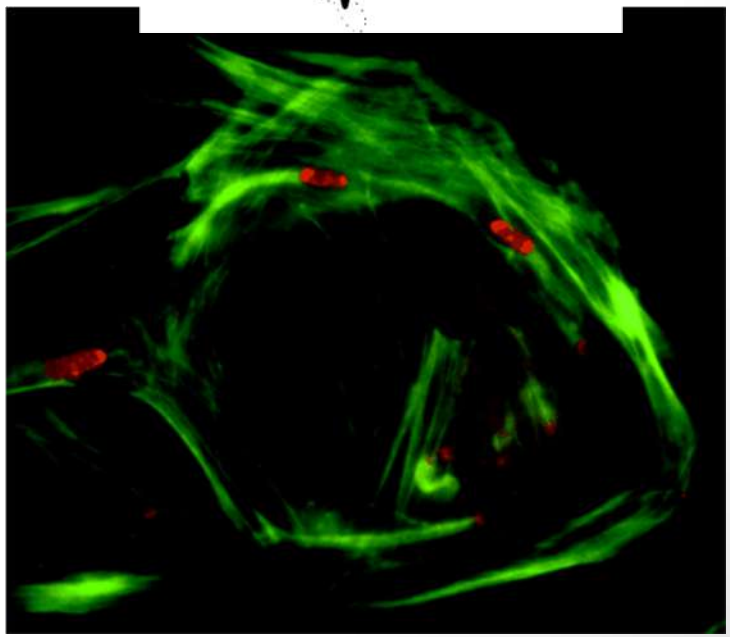
Central themes of this project

Why are these pathogens so infectious?
- we explore their acid resistance (stomach acid)

How do they enter host cells?
- we study regulation of the Type III secretion system (a bacterial conduit that delivers proteins into host cells).

How do these bacteria cause disease in humans?
-one way is to hijack the host's actin cytoskeleton. The bacteria use the actin to move through the host cell cytoplasm!





Through these studies we hope to identify new ways to treat & prevent Shigellosis

Management & Leadership of UNLV VTM production for SNPHL

Through April 2020 and into the Fall, Dr. Wing led a team of volunteers in making VTM(S) media for Southern Nevada Public Health Labs.

Volunteers came from the School of Life Sciences, Department of Chemistry and the UNLV School of Medicine (listed below).

By the end of the project 50,000 vial of medium had been made, which were used by SNPHL Strike teams to test for SARS-Cov-2 (the agent of COVID-19 disease)

UNLV Volunteers:

UNLV SoLS: Monika Karney (Wing Lab Manager and co-lead), Holly Martin (Grad), Tatiana Ermi (Grad), Shrikant Bhute (Post-doc), Isis Roman (Undergrad), Boo Shan Tseng (Asst Prof.) & Cody Cris (Undergrad/Grad).

UNLV Chemistry: Ernesto Abel-Santos (Prof and co-lead), Naomi Okada (Grad), Jacqueline Phan (Grad), Chandler Hassan (Grad), Lara Turello (Grad) & McKensie Washington (Undergrad),

UNLV SoM: James Clark, Michael Briones, Liz Groesbeck & Anita Albanese (all Med students)