

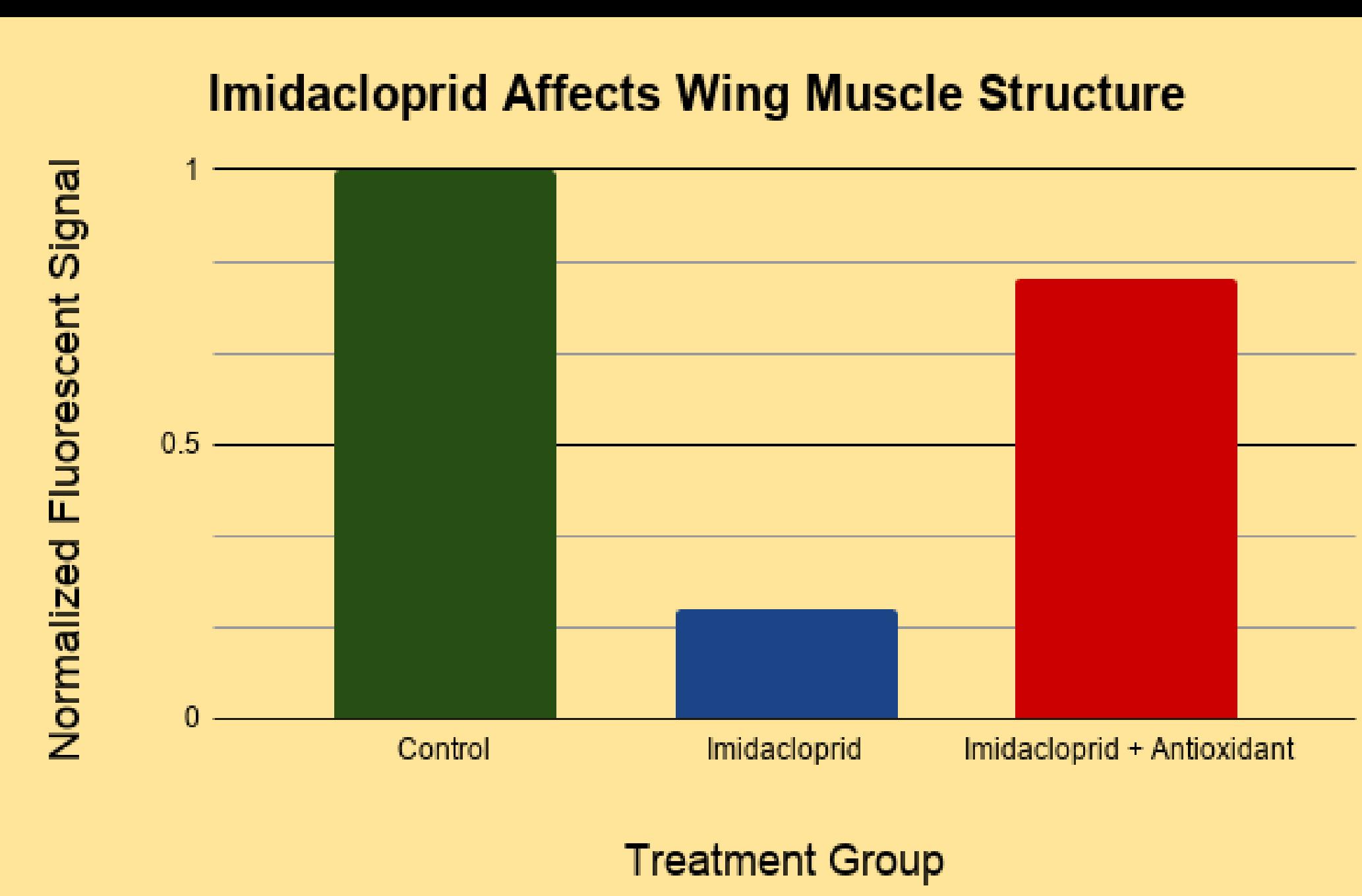


Does the Pesticide Imidacloprid Affect the Wing Muscle Tissue in the Honeybee?

Holly Thelin | Danielle Taylor | Utah Valley University



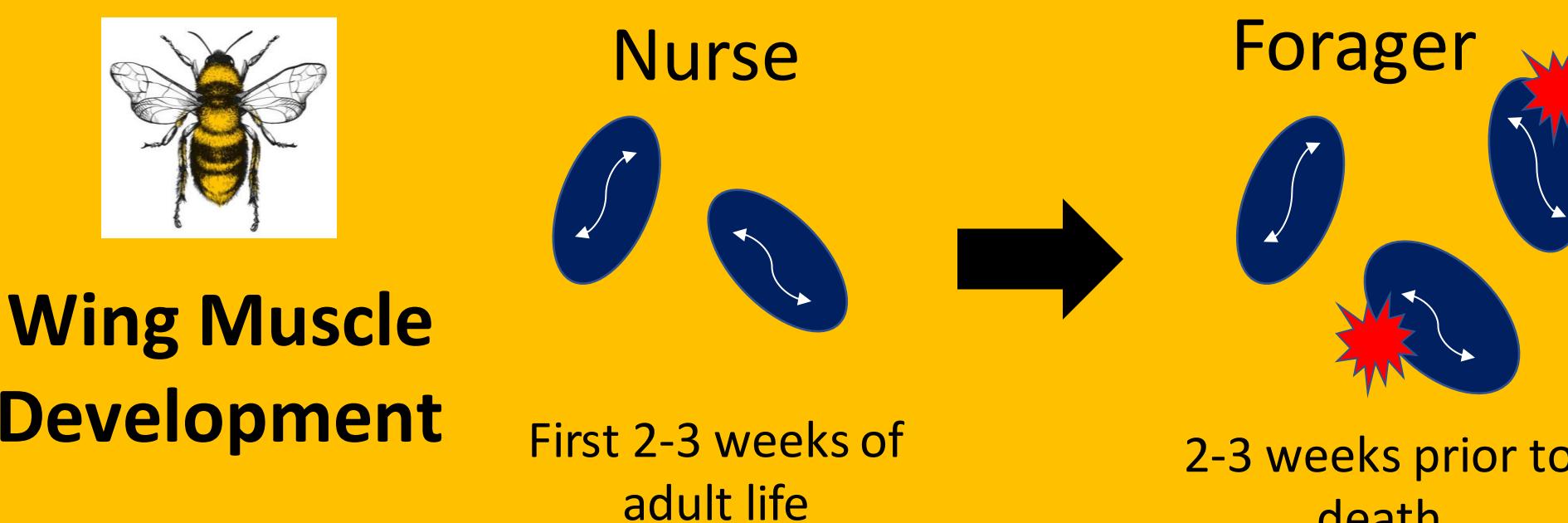
Anticipated Results



This graph shows the expected effects Imidacloprid will have on mitochondrial fluorescent signal

Why Do We Care About Bees?

-1/3 of all the food Americans consume is derived by honeybee pollination. They are also an important part of biodiversity, without them many species of animals and plants we know would vanish.



Bee Wing Muscle Structure:

-As Bees age mitochondria increase in number in nurse bees transitioning to forager bees. Once foragers, repairs cannot be made to mitochondrial damage from oxidative stress.

Hypothesis:

Forager honeybees exposed to sublethal amounts of Imidacloprid will have differences in mitochondrial number or size as determined by fluorescent signal.

Methods:

- Use of fluorescent staining to see the effects of Imidacloprid on mitochondria or muscle structure in the wing tissue.
- Antioxidant treatments that target mitochondria

What about Insecticides?

-Neonicotinoids is the world's most widely used insecticide that causes damaging free radicals in the body affecting bee behavior.

-Ultimately, they can contribute to the collapse of colonies.

-This study revolves around the insecticide Imidacloprid and its contribution to Colony Collapse Disorder.

References:



This work was funded by NSF S-STEM Grant 1833880 to Utah Valley University.

CONVERTING CELLULOSE WASTE INTO GOURMET EDIBLE MUSHROOMS

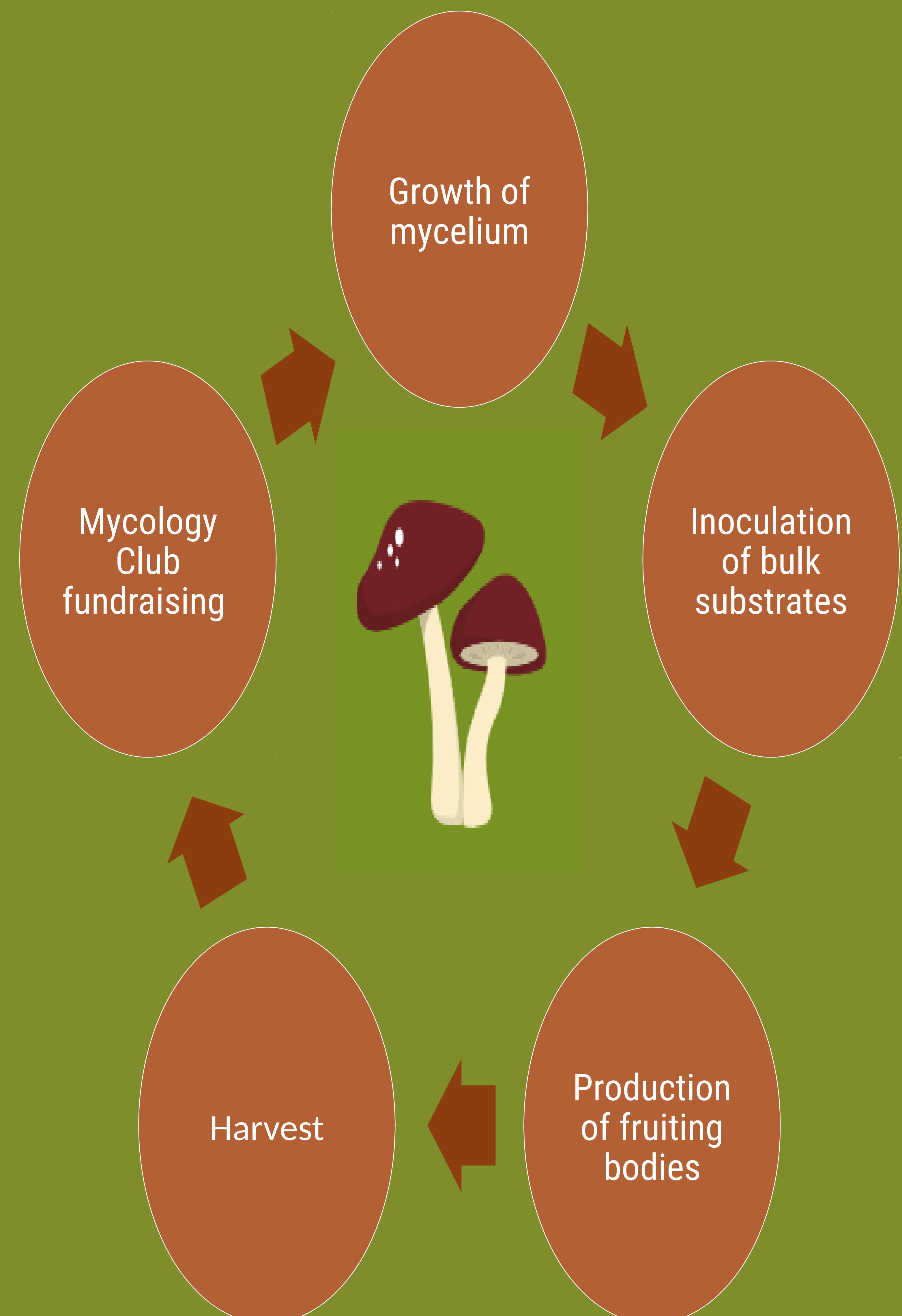
Reagan Dodge | Geoffrey Zahn | UVU Biology Department

PURPOSE

- this project improves on the efficiency of existing mushroom cultivation practices by substituting common waste products for both growth substrate and containers to find the most efficient way to produce higher quantities in mushroom yields

OUTCOMES

- determine the efficiency of several methods for turning waste products into a valuable food product/ cash crop
- determine the development of a fungal strain that improves upon waste transformation efficiency



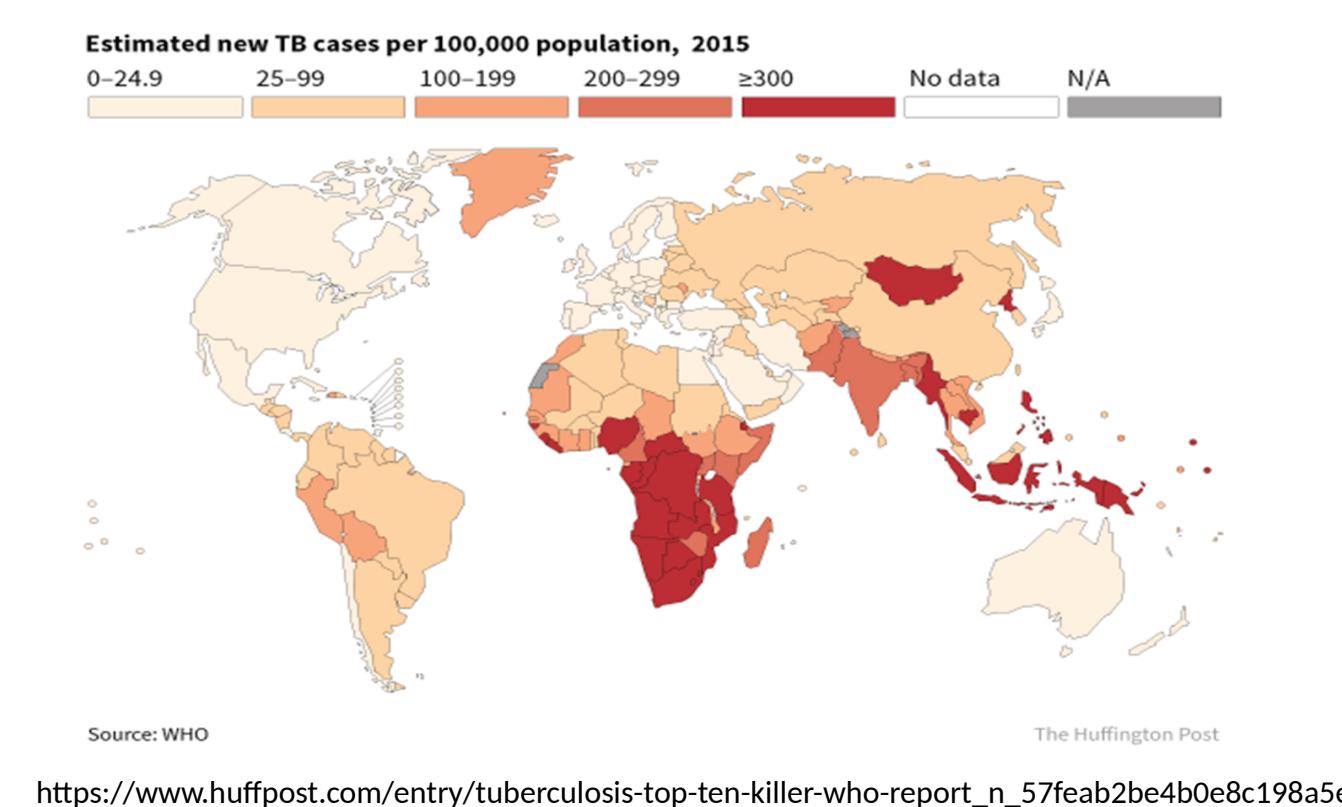
Examining *M. tuberculosis* protein Rv0386 in *M. smegmatis*

Joseph Furniss | Tyler Henderson | Dr. Michaela Gazdik Stofer

Purpose: To understand the role and characteristics of adenylate cyclase protein *Rv0386* in *M. tuberculosis* by using *M. smegmatis* as a model.

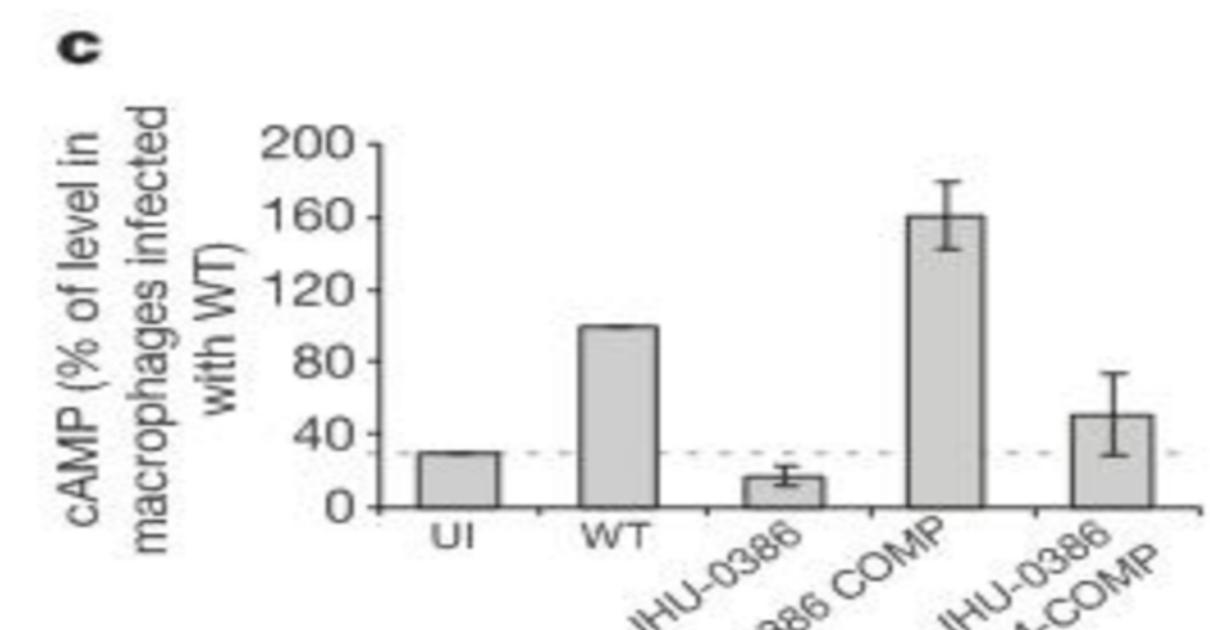
Why important?

- 1/3 of the world's population is infected with TB.
- TB is the leading cause of death from a single infectious agent.
- In 2018, there were about ½ million new cases of rifampicin-resistant TB, a commonly used antibiotic to treat TB.



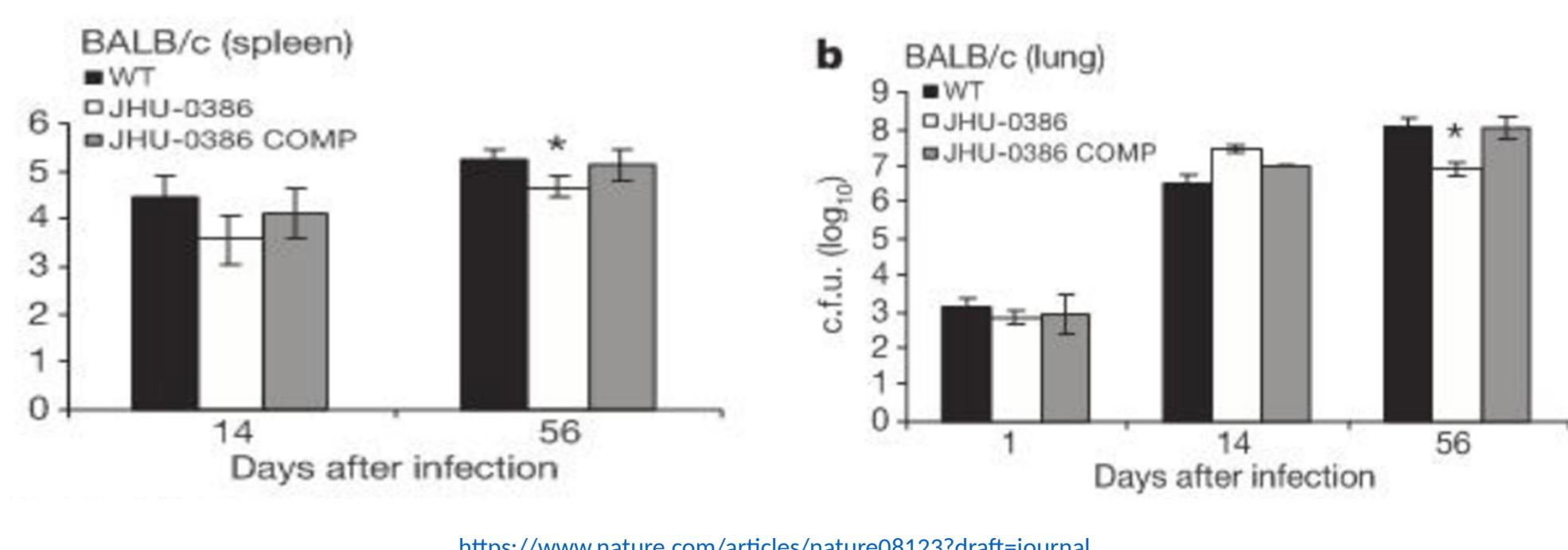
Background

- When TB infects its host there is a burst of cAMP (a signaling molecule) in macrophages.



- The burst of cAMP prevents phagolysosome fusion which allows TB to survive in host macrophages.

- It has been observed that in mutants lacking adenylate cyclase gene *Rv0386* there is a drastic decline in cAMP levels which leads to decreased virulence.



Methods

- Using Gateway® cloning technology we will be able to transfer our gene of interest into *M. smegmatis*.

Why *M. smegmatis*?

- M. smegmatis* is a close relative of TB.
- It is not dangerous to humans.
- Does not naturally have the adenylate cyclase gene *Rv0386*.

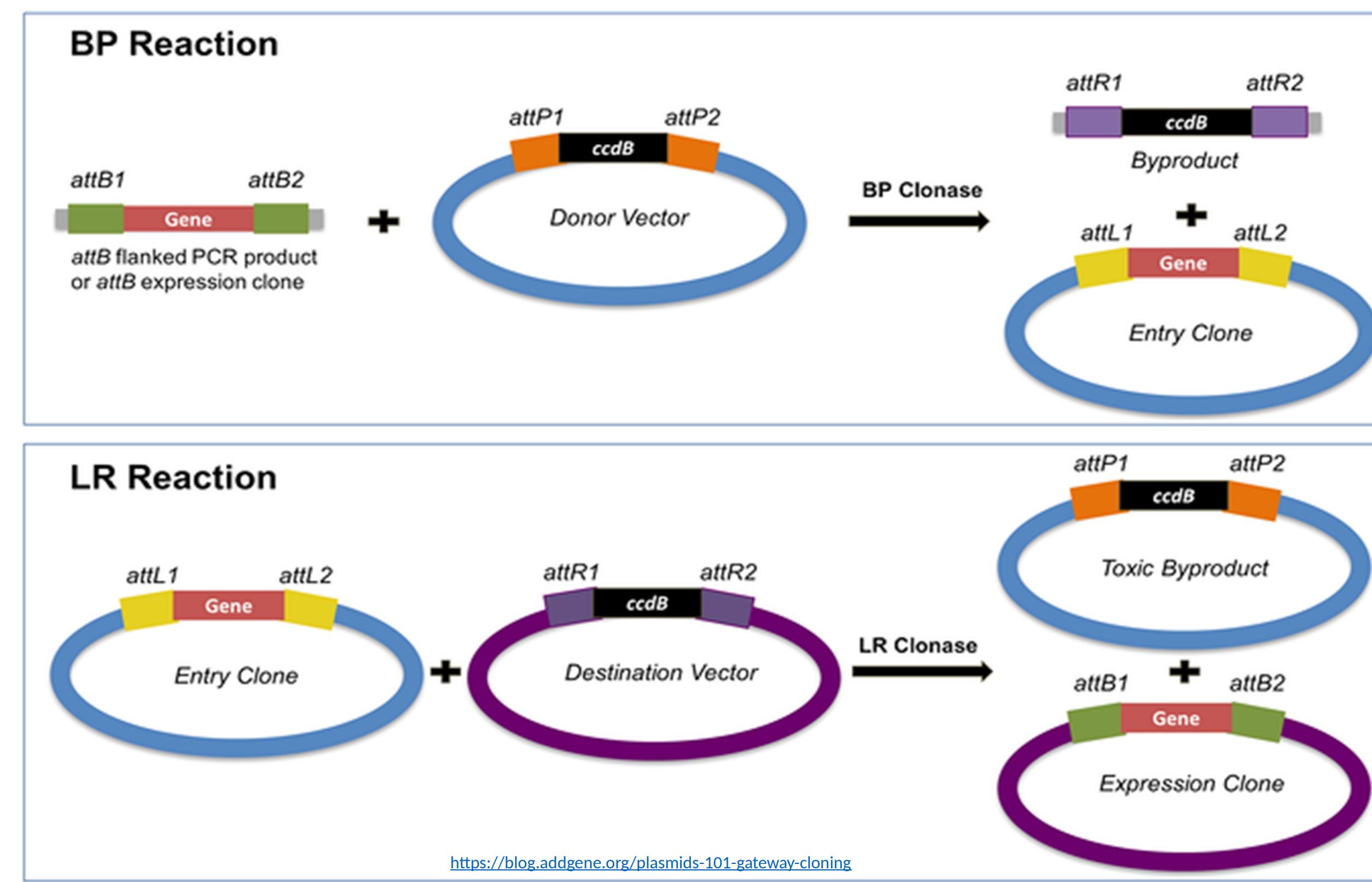
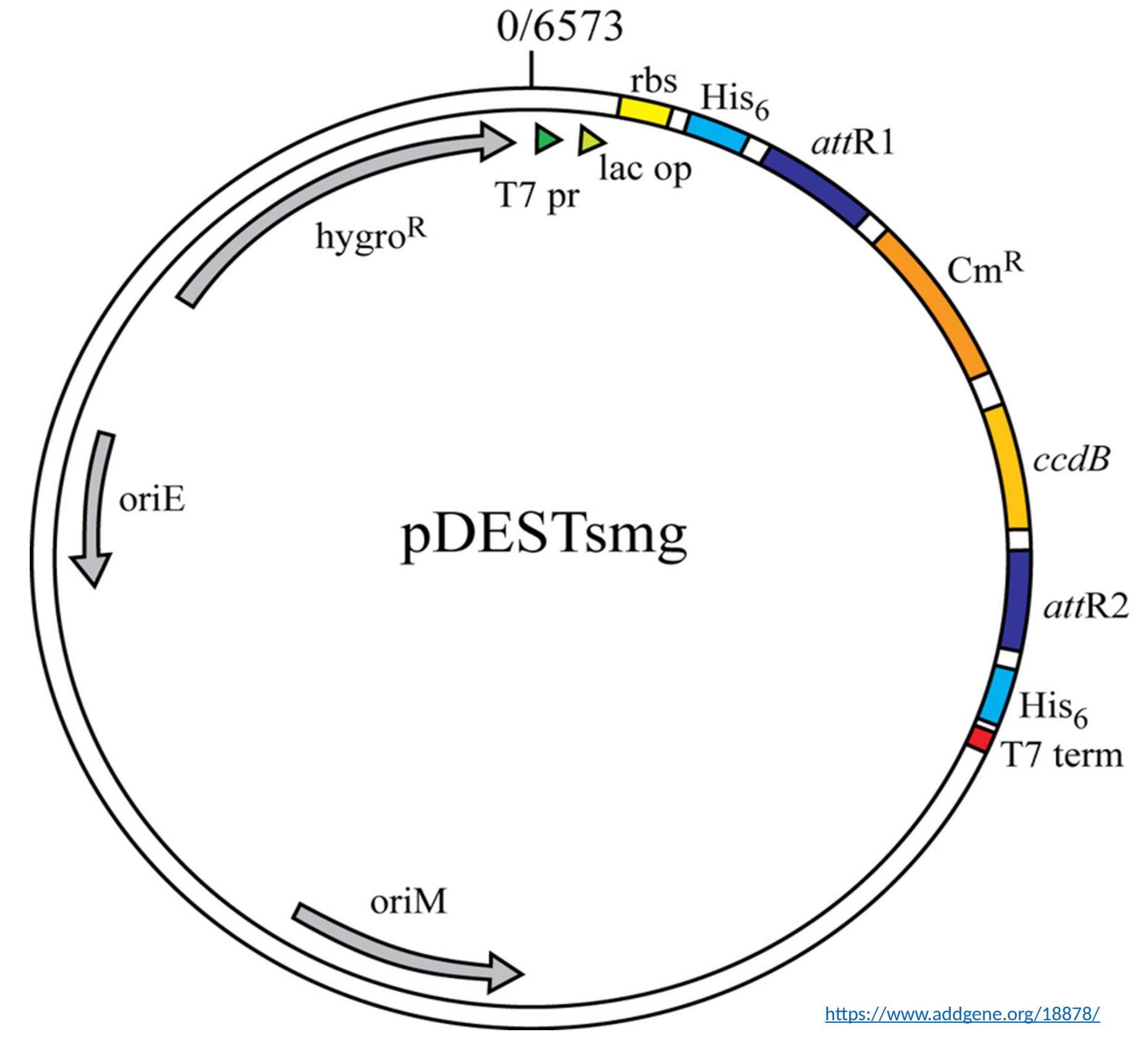


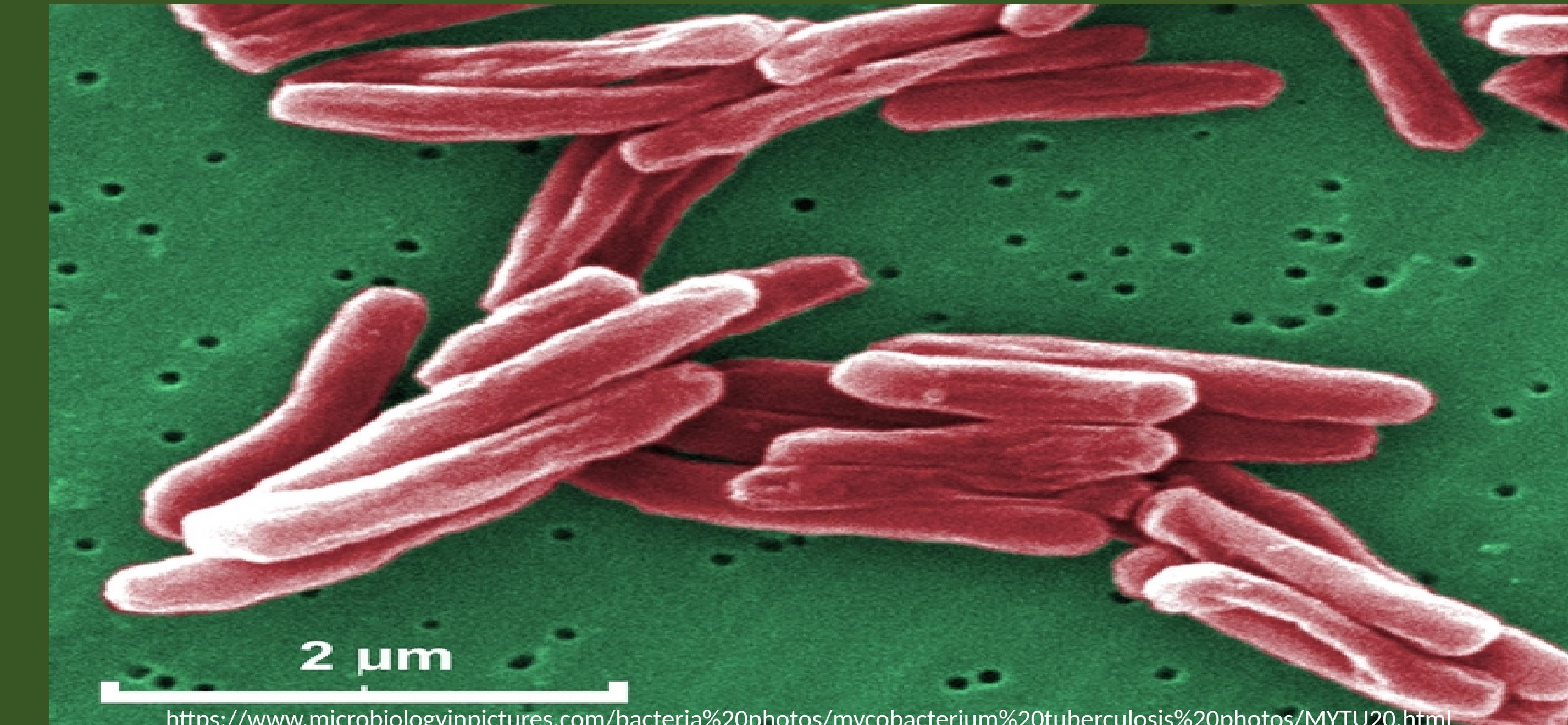
Figure 2: The Gateway system adopts phage integration into the BP and LR reactions. The BP reaction creates an attL-flanked entry clone. The LR reaction creates an expression clone with all of the components necessary for gene expression.

Expected Results

- Because *Rv0386* has been observed to be so essential to the burst cAMP in TB we should see a burst in cAMP levels in *M. smegmatis*.

Next Steps

- Test whether *M. smegmatis* has an increased ability to survive in macrophages.
- Observe how *Rv0386* is oriented on the cell membrane.



References

- Agarwal N, Lamichhane G, Gupta R, Nolan S, Bishai WR. Cyclic AMP intoxication of macrophages by a Mycobacterium tuberculosis adenylate cyclase. *Nature*. 2009 [accessed 2019 Nov 29];460(7251):98–102. <https://www.nature.com/articles/nature08123>; doi:10.1038/nature08123
- Drug-Resistant TB. Centers for Disease Control and Prevention. 2017 Jan 17 [accessed 2019 Nov 29]. <https://www.cdc.gov/tb/topic/drtb/default.htm>
- "Global Tuberculosis Report 2019." World Health Organization. World Health Organization, November 18, 2019. https://www.who.int/tb/publications/global_report/en/
- Goldstone RM, Moreland NJ, Bashir G, Baker EN, Lort JS. A new Gateway® vector and expression protocol for fast and efficient recombinant protein expression in *Mycobacterium smegmatis*. Protein Expression and Purification. 2008 [accessed 2019 Nov 29];57(1):81–87. <https://www.sciencedirect.com/science/article/pii/S104655200700201X?via%3Dihub>; doi:10.1016/j.pep.2007.08.015
- Johnson RM, Mcdonough KA. Cyclic nucleotide signaling in Mycobacterium tuberculosis: an expanding repertoire. *Pathogens and Disease*. 2018 [accessed 2019 Nov 29];76(5). <https://academic.oup.com/femsfd/article/76/5/fy048/4995197>; doi:10.1093/femsfd/fy048
- Tuberculosis (TB). World Health Organization. 2019 Oct 17 [accessed 2019 Nov 29]. <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>
- Tuberculosis control. World Health Organization. 2010 Dec 8 [accessed 2019 Nov 29]. https://www.who.int/trade/distance_learning/gpg/gpg3/en/index1.html

Like what you
see? Take it with
you!



ARE PENGUINS TRULY MONOGAMOUS OR DO GENETIC PATERNITY TESTS REVEAL OTHERWISE?

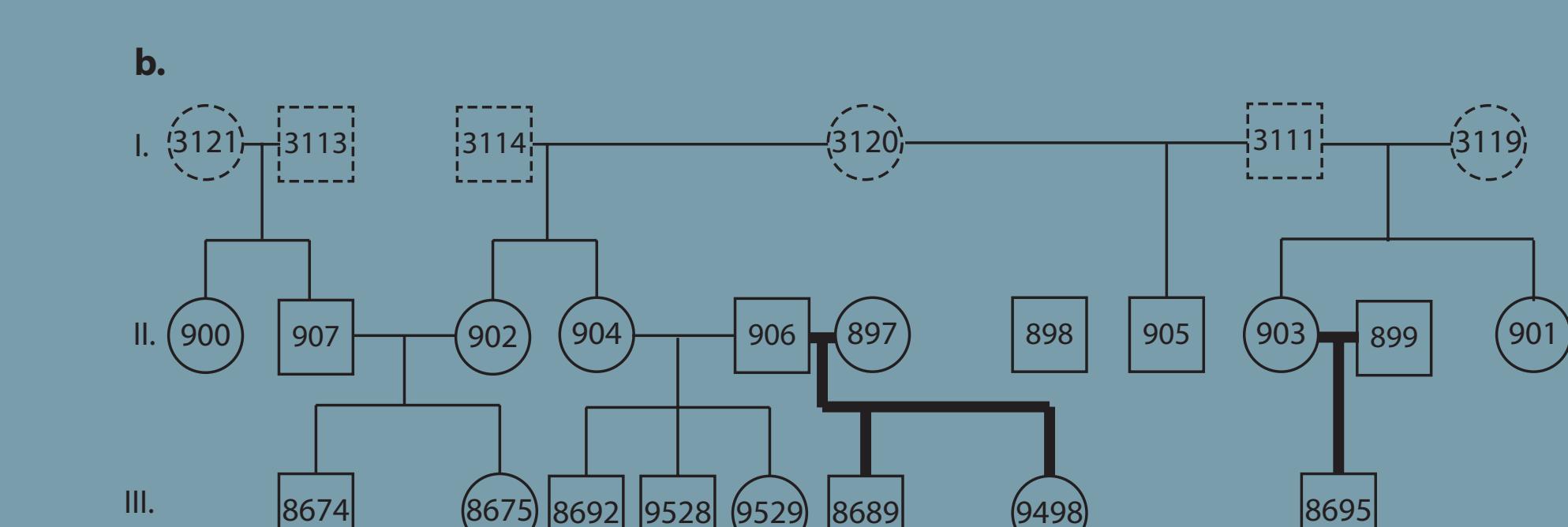
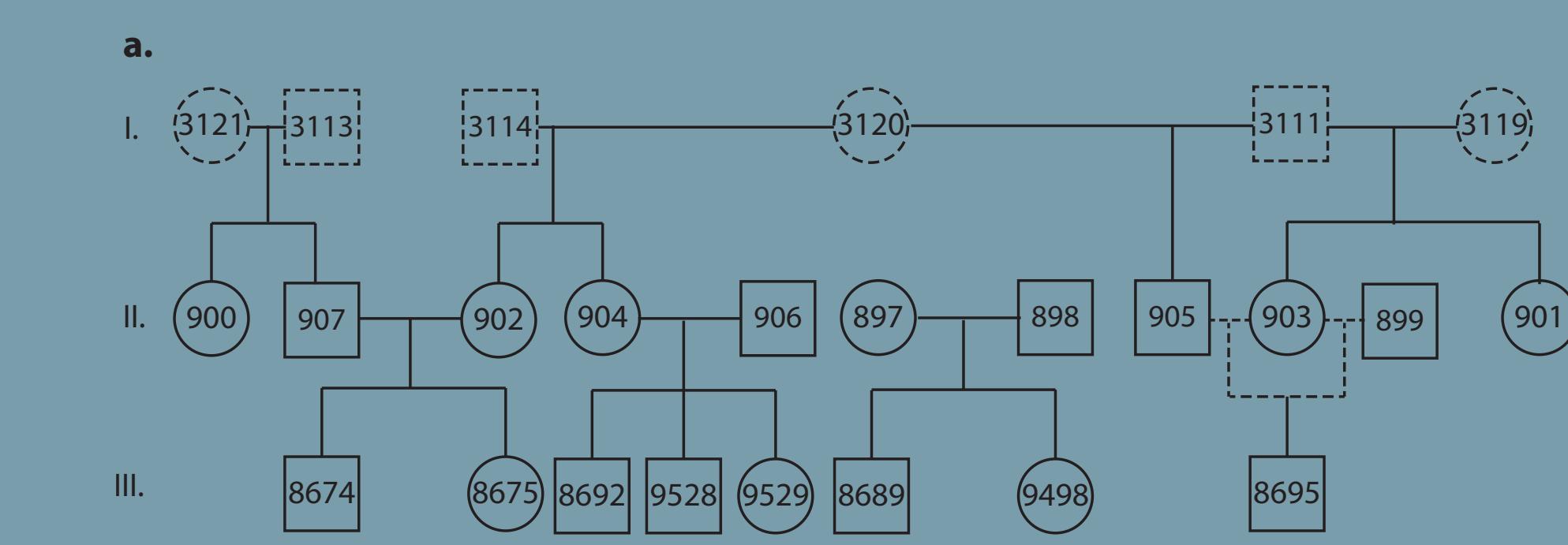
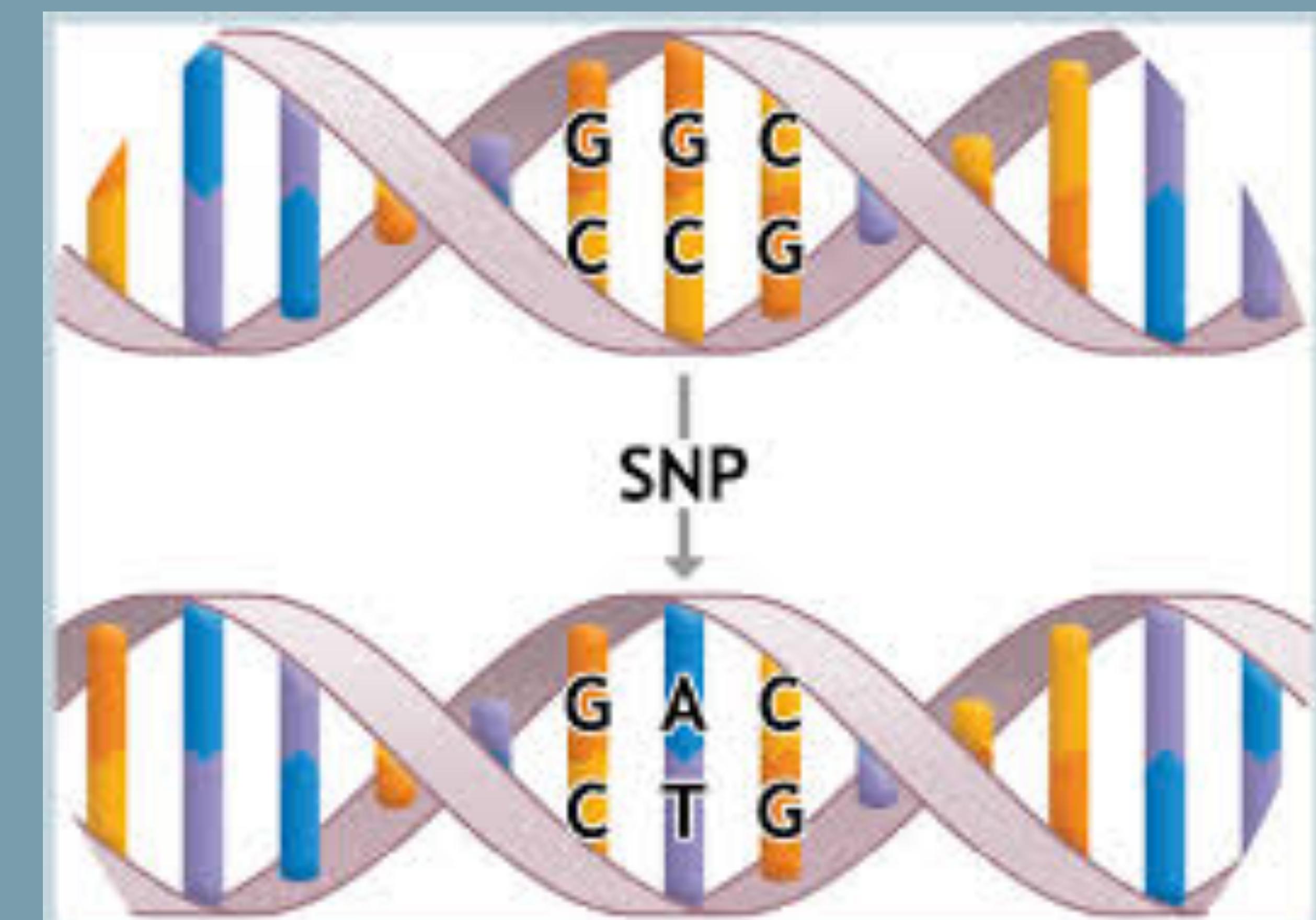
SARA ASH | DR. ERIC DOMYAN | UTAH VALLEY UNIVERSITY

Abstract

- Penguins are socially monogamous; but few studies have determined the extent to which this translates to biological monogamy.
 - A young penguin's social father, may not always be its biological father.
- In our most recent study we teamed up with the Loveland Living Planet Aquarium to study their Gentoo penguins. We found that 2 of the 8 offspring were sired by a male other than the one listed in the Species Survival Plan.
 - However, it is unknown whether these findings describe an anomalous occurrence, or whether they are generalizable to other institutions, environments, or species.
- Genetic tests can help determine the extent to which extra-pair mating has occurred, which can minimize inbreeding depression that could reduce the biological fitness of the population.
 - We would like to compare rates of extra-pair paternity among wild vs. captive populations, and between different species of penguins, to see how similar or different the rates are.

Methods

- Contact a variety of Aquariums and Zoos and researchers in Antarctica for blood samples.
- Extract DNA from the red blood cells of each penguin.
- Sequence the DNA using Illumina Next-Gen sequencing.
- Use Genotype-by-Sequencing (GBS) Using STACKS (Catchen et al. 2011, G3) to Identify places where some of the penguins are different from the others.
 - Single-nucleotide polymorphism (SNP)
- Perform Kinship analysis using KING (Manichaikul et al. 2010 bioinformatics) to compare the patterns of SNPs to see which penguins are most similar.
- Use the kinship analysis scores to estimate the relationships between penguins.
 - Higher the score, closer the relationship
- Compare the relationships determined by DNA testing to those determined by observation.
 - Conclude whether extra-pair paternity has occurred and if so, determine what the rate of EPP is.



SCAN ME

Is light pollution affecting mortality rates in brine shrimp?

Emma Duke | Paul Dunn

Does the amount of light affect the mortality rates of positively phototactic *Artemia franciscana*?

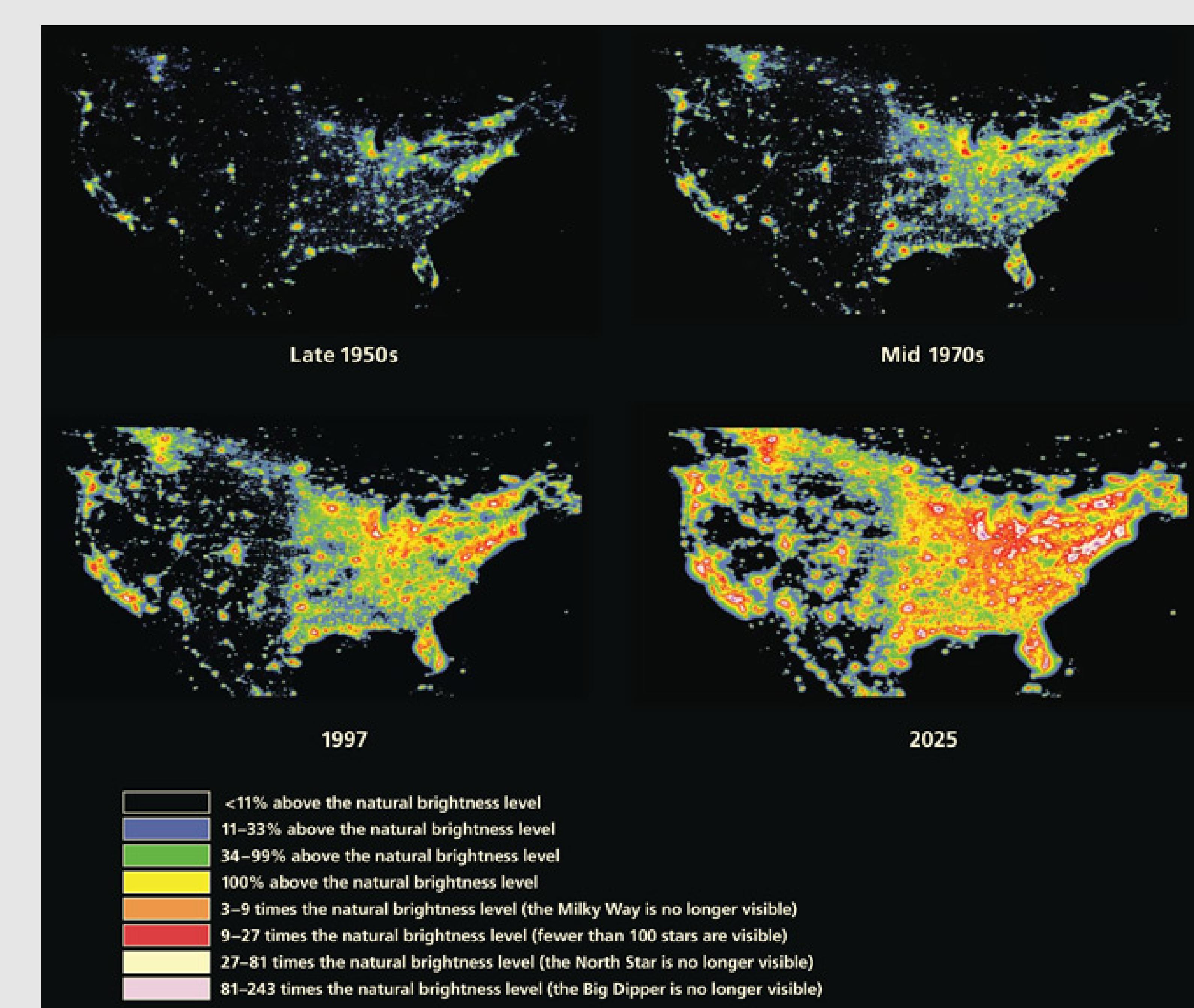


For references:



- Light pollution has been increasing dramatically since the 1950's (as seen in graphic).
- Light pollution disrupts the normal day/night sleep cycle of wildlife.
- Certain animals can either be positively or negatively attracted to light.
- Some animals, like sea bass, benefit with more light.
- Brine shrimp have shown to hatch with higher frequency and success rates with more light.

Because they are attracted to light, brine shrimp tend to swarm in specific areas, and may use up local resources more quickly and exert more energy due to increased activity.



Hypothesis

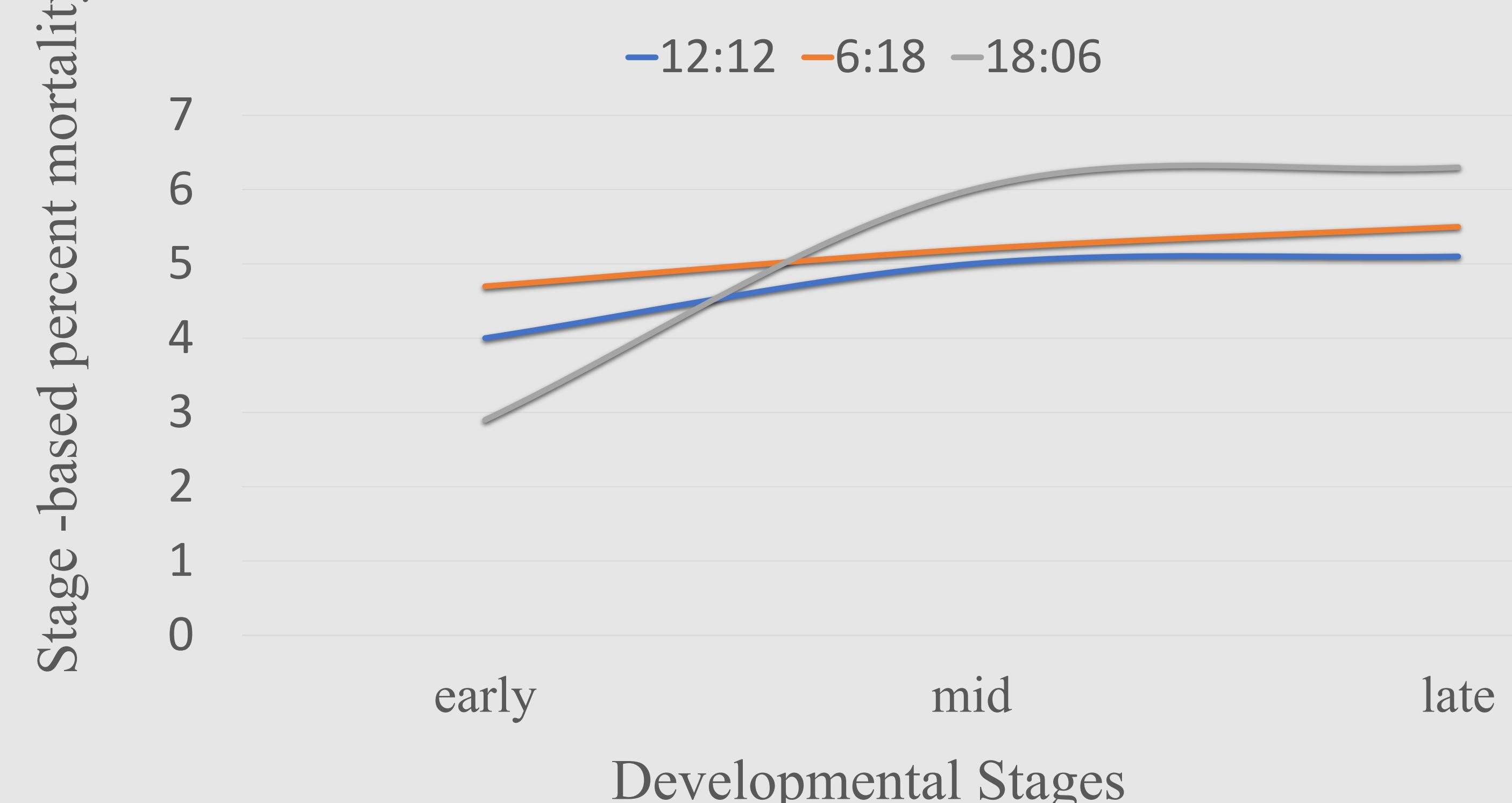
- **Null:** The amount of light will not significantly affect the mortality rates.
- **Alternative:** Initially, the animals on the high-light treatment will experience lower mortality, but as the experiment progresses and more energy is expended swimming towards the light, the high-light treatment will experience higher mortality than the moderate- and low-light treatments.

Methods

- Light treatments: 12 hours light on/12 hours light off; 18 hours light on/6 hours light off; 6 hours light on/18 hours light off.
- The salinity, food, and frequency of when I check them will be the same for all treatments.
- Three individuals of *A. franciscana* will be kept in 6-well cell culture plates.

For future experiments, I'll use different intensities of light, or different wavelengths to see how they affect the mortality rates.

Expected Results

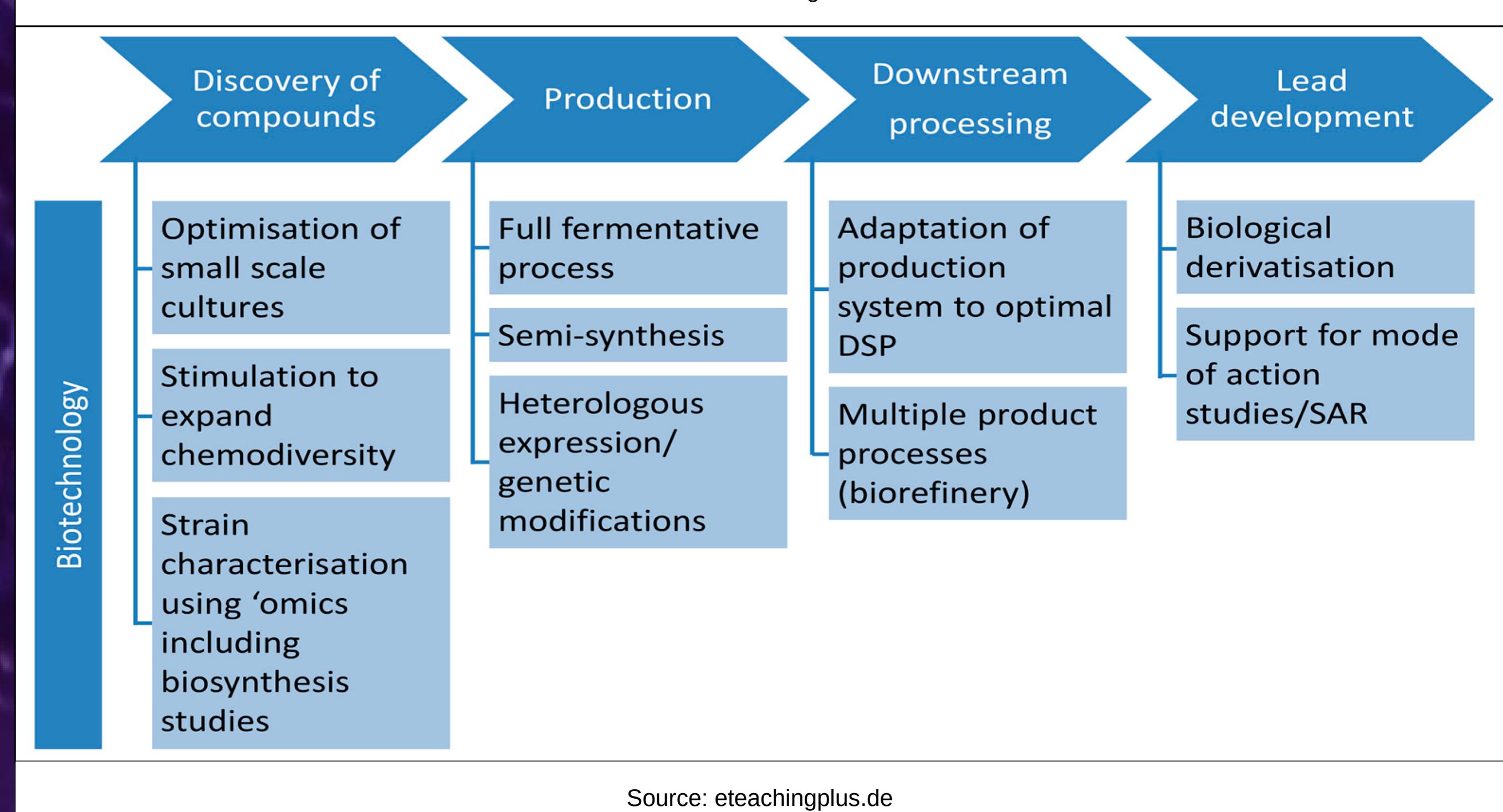
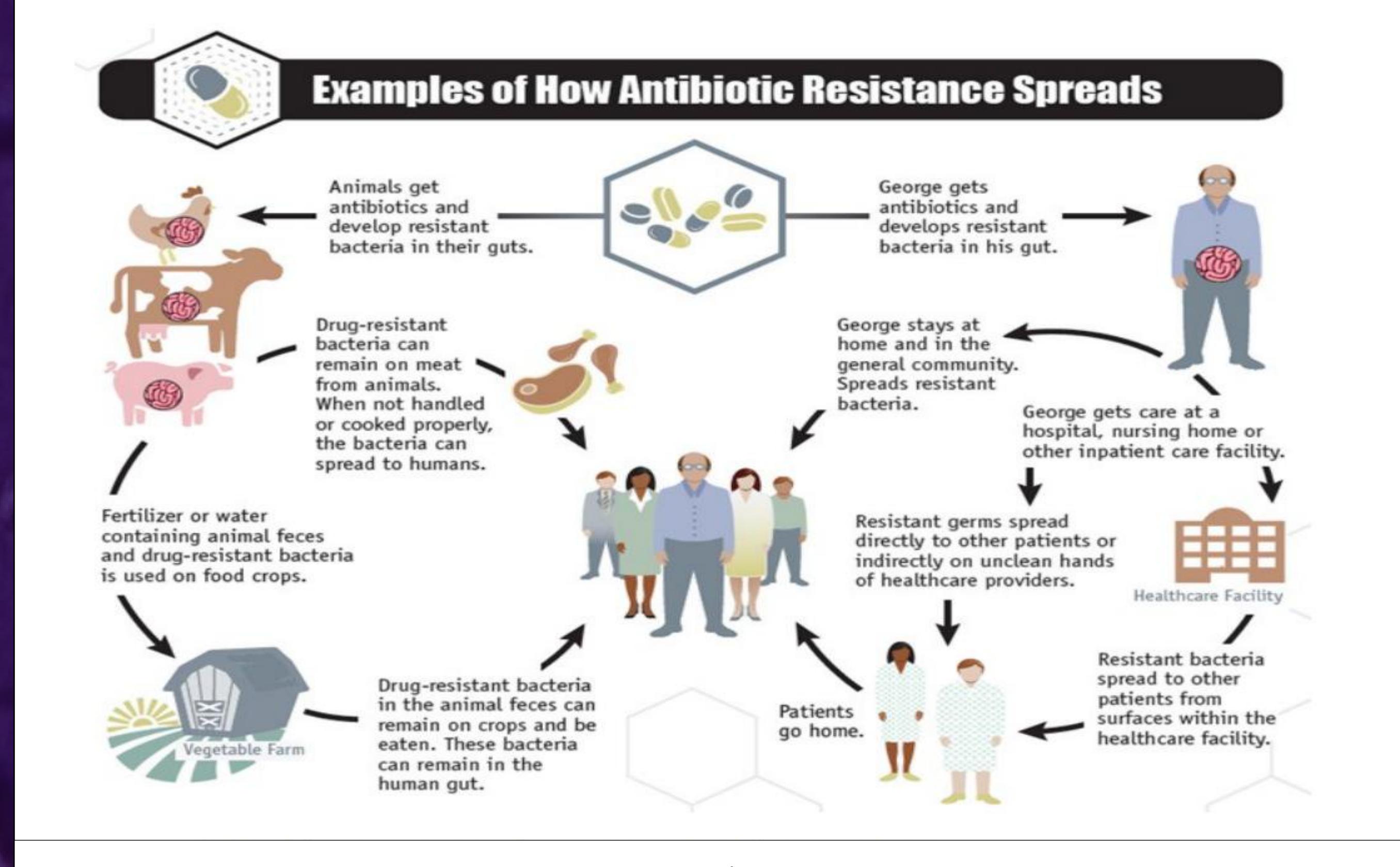
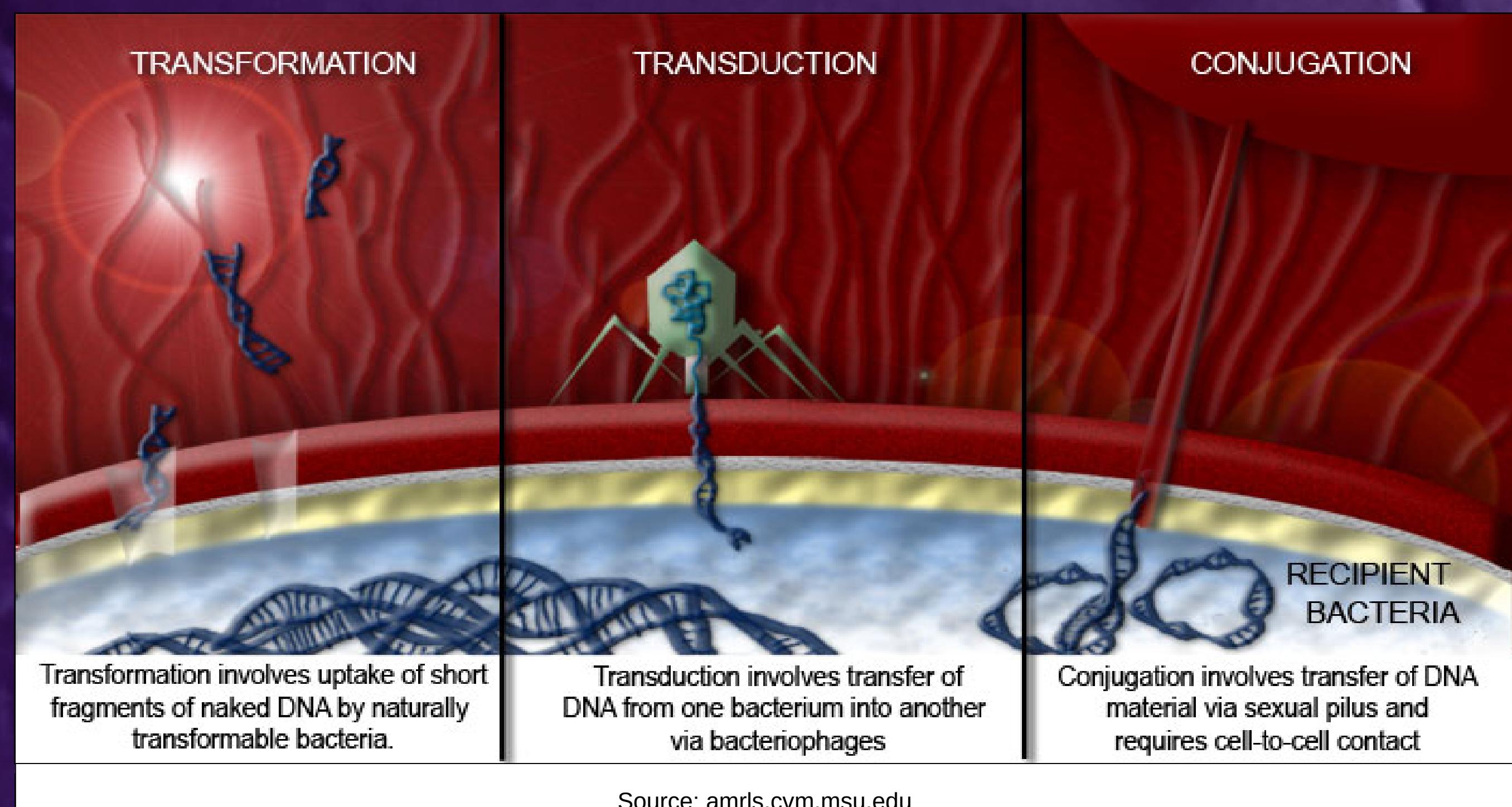


Isolating Fungal Adjutants for use in Bioremediation

Alyssa Tidwell | Dr. Geoffrey Zahn | Utah Valley University



Pharmaceuticals in wastewater create superbugs that kill thousands per year. Can fungi help to stop them from evolving?



According to the CDC, more than 28 million antibiotic-resistant infections occur in the US per year, causing 35,900 deaths annually. This is largely due to an overabundance of antibiotics in our environments from wastewater and in our bodies through over-prescribed medicines.

To combat the exponential evolution rates of these superbugs, it has been proposed that decreasing the levels of antibiotics in environmental systems would reduce the occurrence of antibiotic-resistant genes through horizontal gene transfer.

Our goal is to aid in those efforts by isolating fungal strains that have the ability to break down antibiotic compounds, thereby lowering the concentration of antibiotics in our water systems.

For more information about this project, scan the QR code to visit alyssaktidwell.wixsite.com/fungi

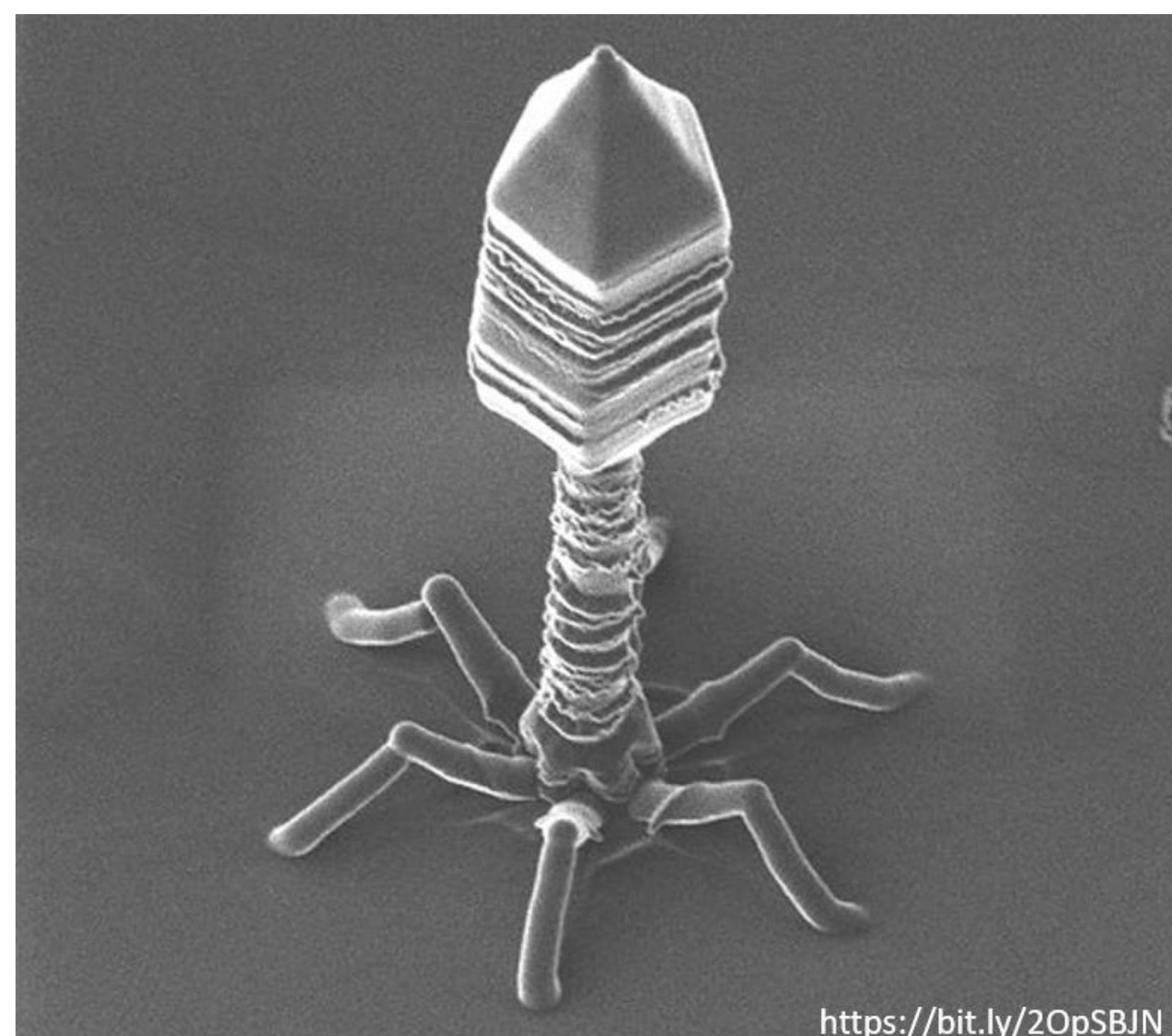


Fishing For Phages: Defeating Superbugs

Rhett Sudweeks & Professor Alma Laney

Introduction

- Bacteria are becoming more resistant to antibiotics as each day passes. This project is to find a bacteriophage that is capable of infecting human pathogens and making them less resistant.

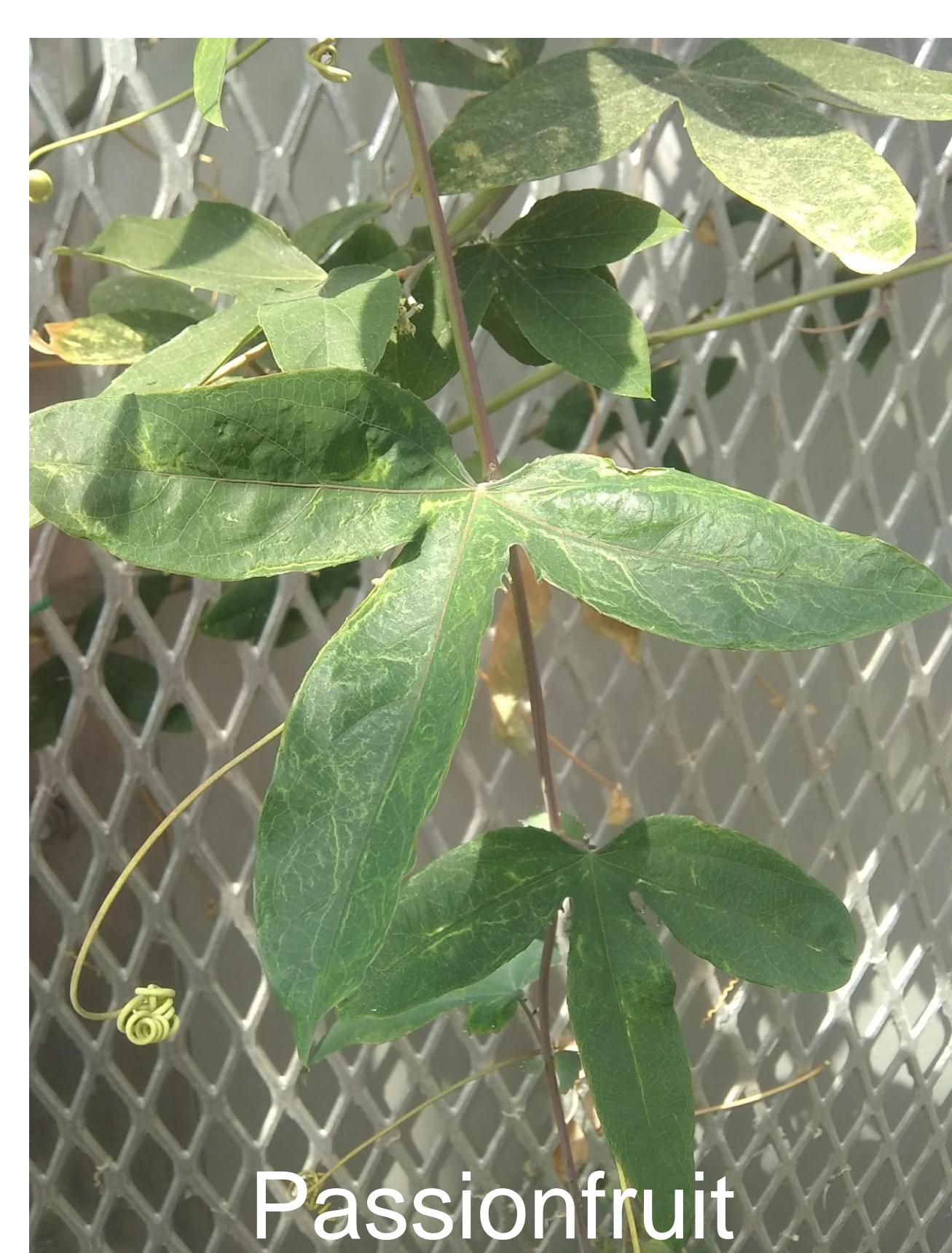


Learning Virological Methods

- DNA/RNA Sequencing
 - Sanger
 - Illumina
 - Oxford Nanopore (MinION)
 - Enrich for Viral Nucleic Acids (dsRNA)
- DOP-RT PCR¹
- RCA (DNA)²
- Cloning



Hibiscus

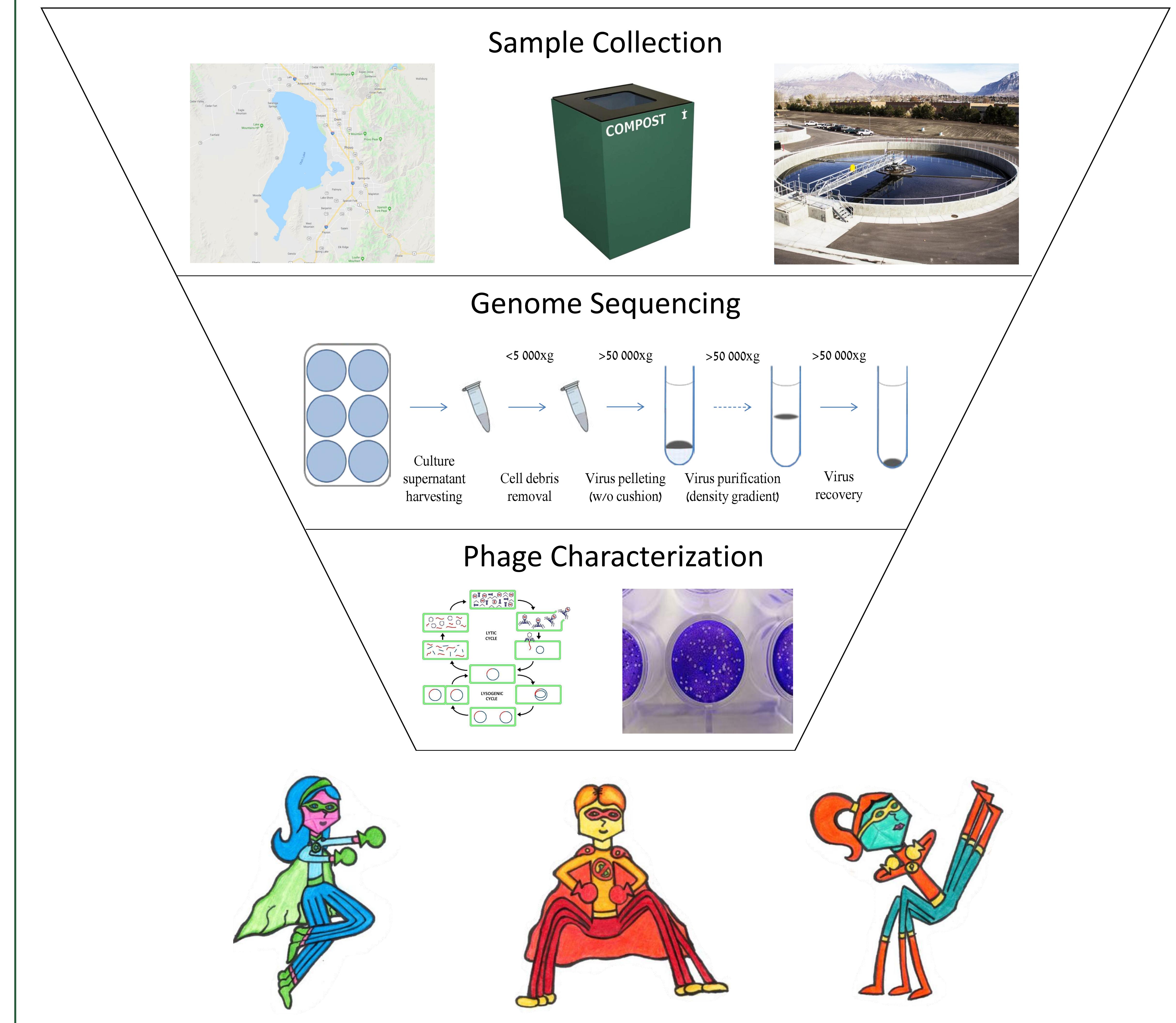


Passionfruit

Acknowledgements

- Funding provided by NSF Grant (DUE – 1833880)
- Guidance and knowledge offered by Professor Alma Laney (Mentor)

Can We Find a New Bacteriophage for Human Pathogens?



Expected Outcomes

- Finding a bacteriophage that is capable of infecting human pathogens
- Relatable to my future career goals
- Potential for publication of the findings
- Attending local, regional, and national meetings to present the findings

References

- 1: Laney et al., 2011.
DOI: 10.1099/vir.0.031146-0
- 2: Laney et al., 2012.
DOI: 10.1094/PHYTO-12-11-0351



Why Do Some Viral Hosts Die

Riley Rowberry, Alma G. Laney

Introduction

A mealybug transmitted virus has infected the philodendron population in the UVU greenhouse.

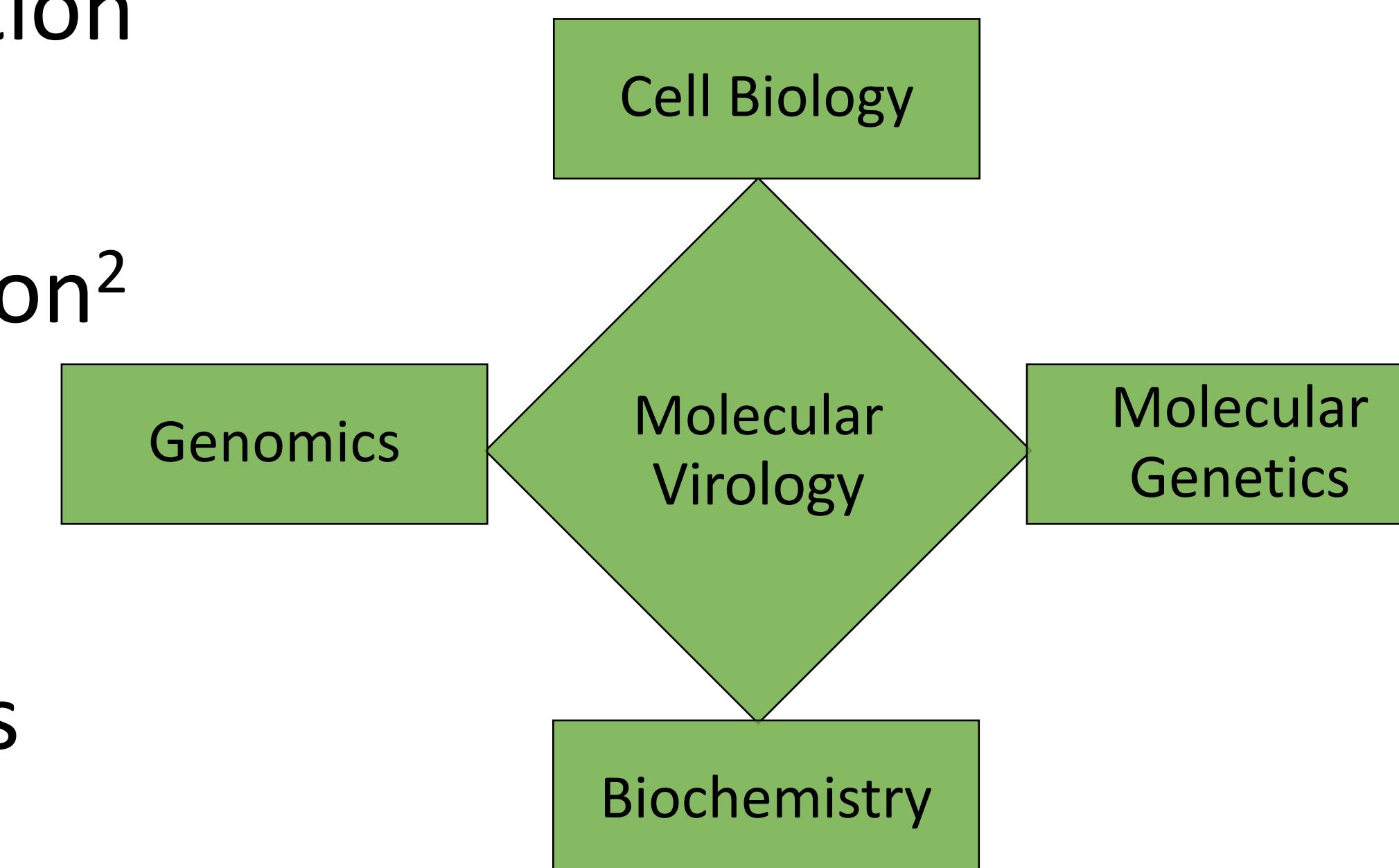
Is this a known virus? Is it new? Why are some hosts dying?



<https://bit.ly/2RbDyWU>

Learning Techniques on Known Viruses

- Viral nucleic acid purification
 - dsRNA¹
 - Rolling circle amplification²
- DNA/RNA sequencing
- Real Time PCR
- Using Degenerate Primers
- Cloning

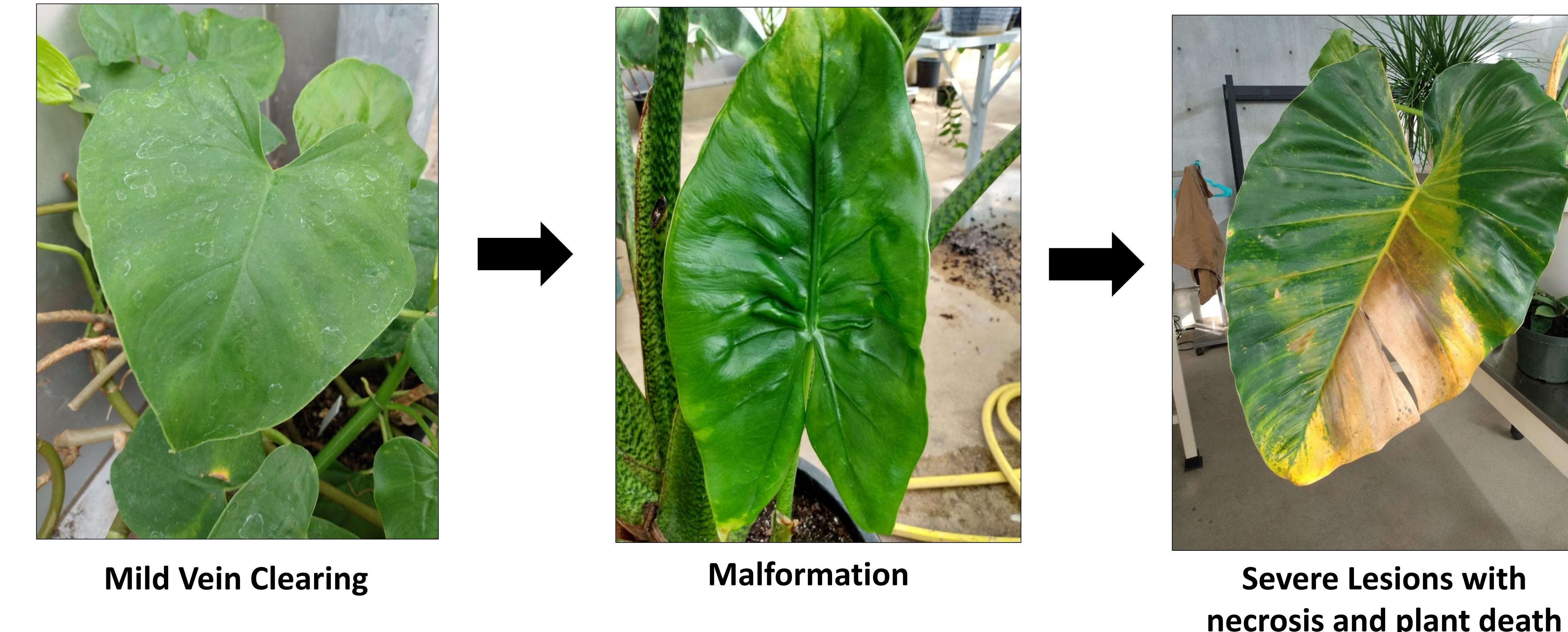


References

- 1) Laney et al., 2011. DOI: 10.1099/vir.o.031146-0T
- 2) Laney et al., 2012. DOI: 10.1094/PHYTO-12-11-0351

Identifying The Philodendron Virus

Variation of Symptoms: Is this the same virus?



Expected Project Outcomes

- | | | |
|---|---|--|
| • Research: | • Professional: | • Personal Development: |
| <ul style="list-style-type: none"> • Identify New Virus • Transcript response genes in related species • Fulfill Koch's postulates for viruses | <ul style="list-style-type: none"> • Publication(s) • Attend local, regional, and national conference | <ul style="list-style-type: none"> • Develop new skills as a researcher • Build relationships with other researchers |

Acknowledgements

- Guidance and knowledge offered by mentor, Dr. Alma G. Laney
- NSF Grant #1833880

Evolution of Flight in Insects: Mayfly Family Trees

Emily Hyer, Natalia Backman, & Dr. T. Heath Ogden

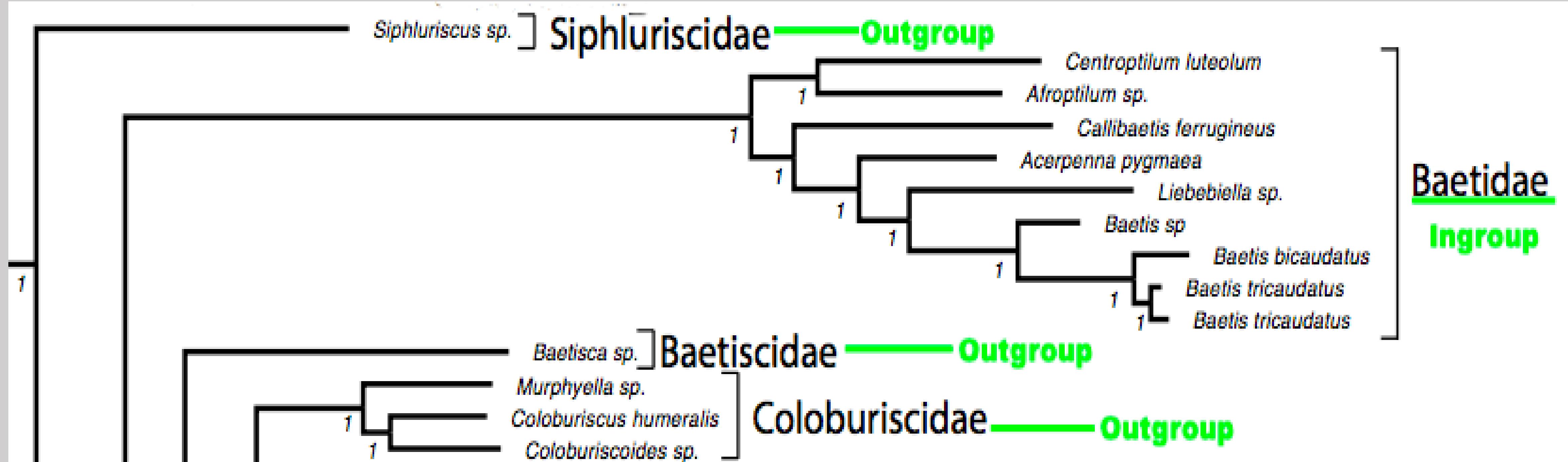
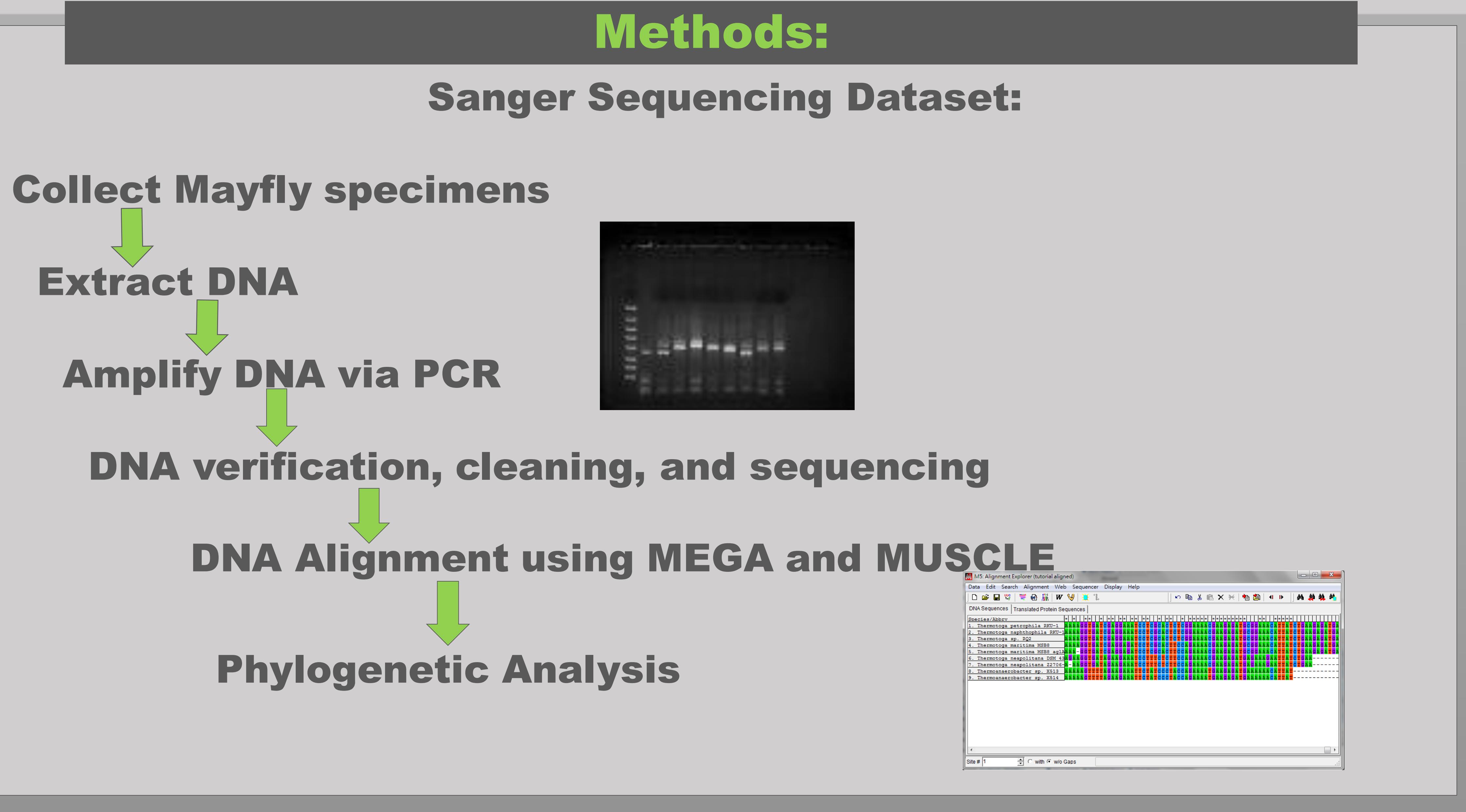
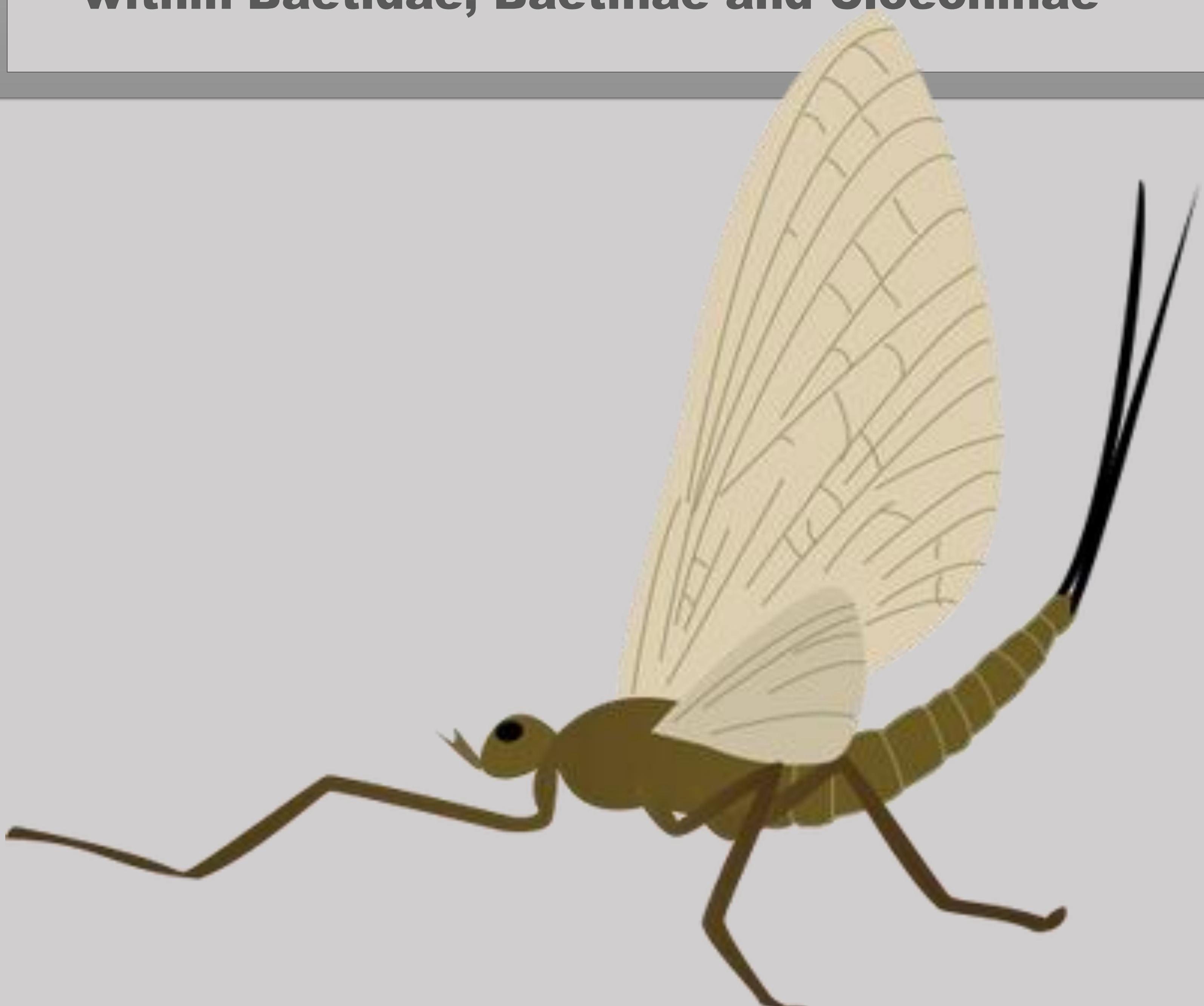
Molecular DNA data will help resolve relationships within the family Baetidae and is key to understanding evolutionary trends, such as the origins of wings and flight.

Hypothesis:

- Molecular DNA data will show that Baetidae is a monophyletic family
- This will help answer the question of where and when insect wings evolved

Former Research:

- A leading hypothesis is that wings in insects developed through the modification of mayfly-like gills in the common ancestor of all insects
- It is thought that there are two subfamilies within Baetidae; Baetinae and Cloeoninae



Future Work:

- Continuation of collection of molecular DNA data using the genes 12s, 16s, H3, 18s, 28s and CO1
- Use Transcriptomic data to get more conclusive evidence



Can diet alleviate the cognitive decline seen in Alzheimer's Disease?

Sarah Quist & Danielle Taylor, PhD
Utah Valley University, Orem, Utah 84058



❖ Background

❖ Alzheimer's Disease

- ❖ Neurodegenerative disorder that affects cerebral cortex and hippocampus
- ❖ Evidence that oxidative damage from free radicals plays a role
- ❖ Accumulation of Beta-amyloid plaques
- ❖ Neurofibrillary tangles in neurons

❖ Supplemented Diet

- ❖ Berries contain antioxidant properties and may have potential neuroprotective effects
- ❖ Turmeric shows antioxidant, anti-inflammatory, lipophilic actions and improves cognitive function
- ❖ Coconut oil has antioxidant, anti-inflammatory and lipid lowering properties

❖ Methods

- ❖ Fruit flies expressing Alzheimer's disease
- ❖ Experimental group supplemented with freeze dried berry mixture, turmeric and coconut oil
- ❖ Memory/learning tested in T-maze
- ❖ Dissect brains of fruit flies to see changes in plaques and tau tangles

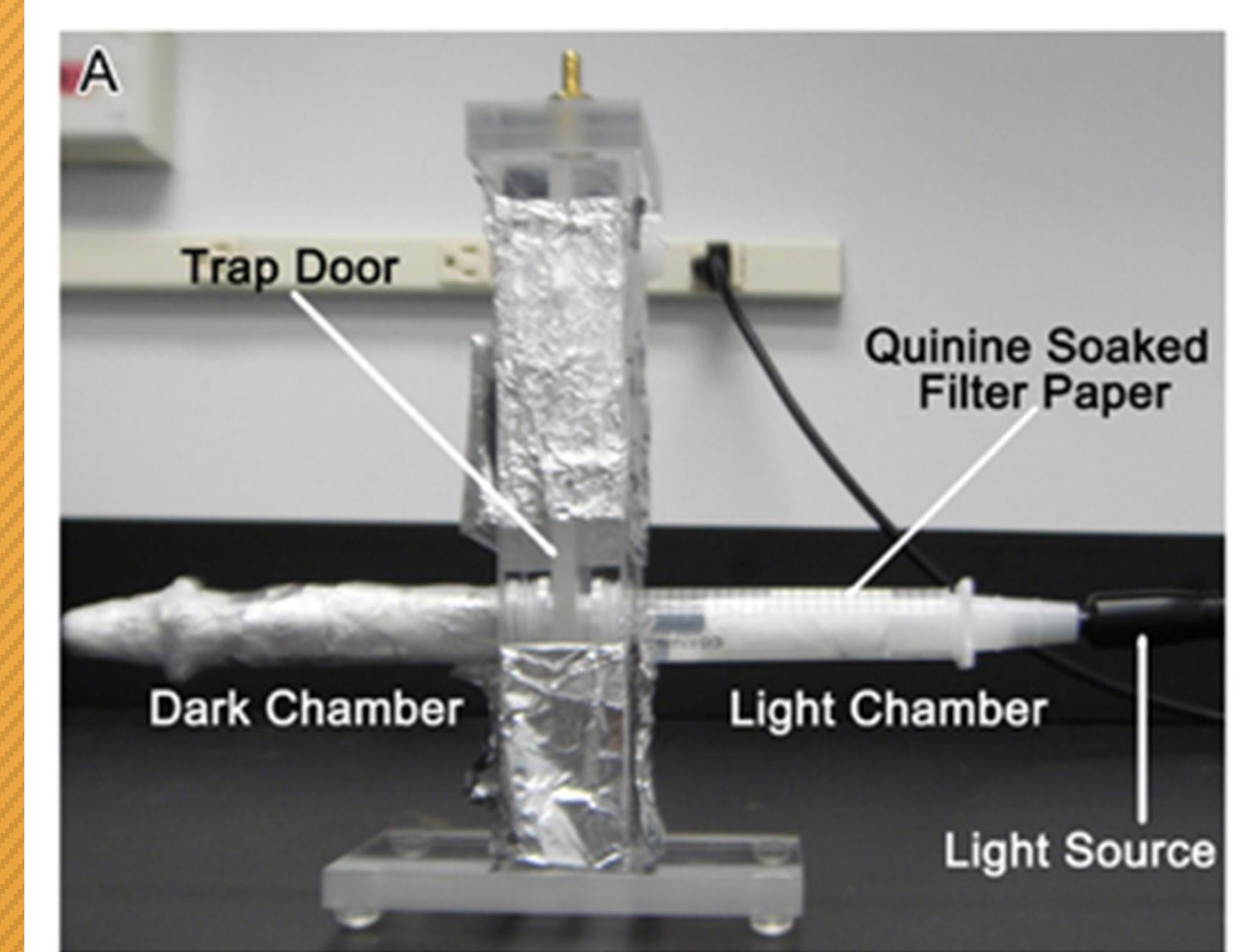


Figure from Ali, Escala, Ruan, & Zhai (2011)

T-Maze setup to test fly's ability to remember that light is associated with the bitter taste of quinine



Figure from Acharya, S. (2017)

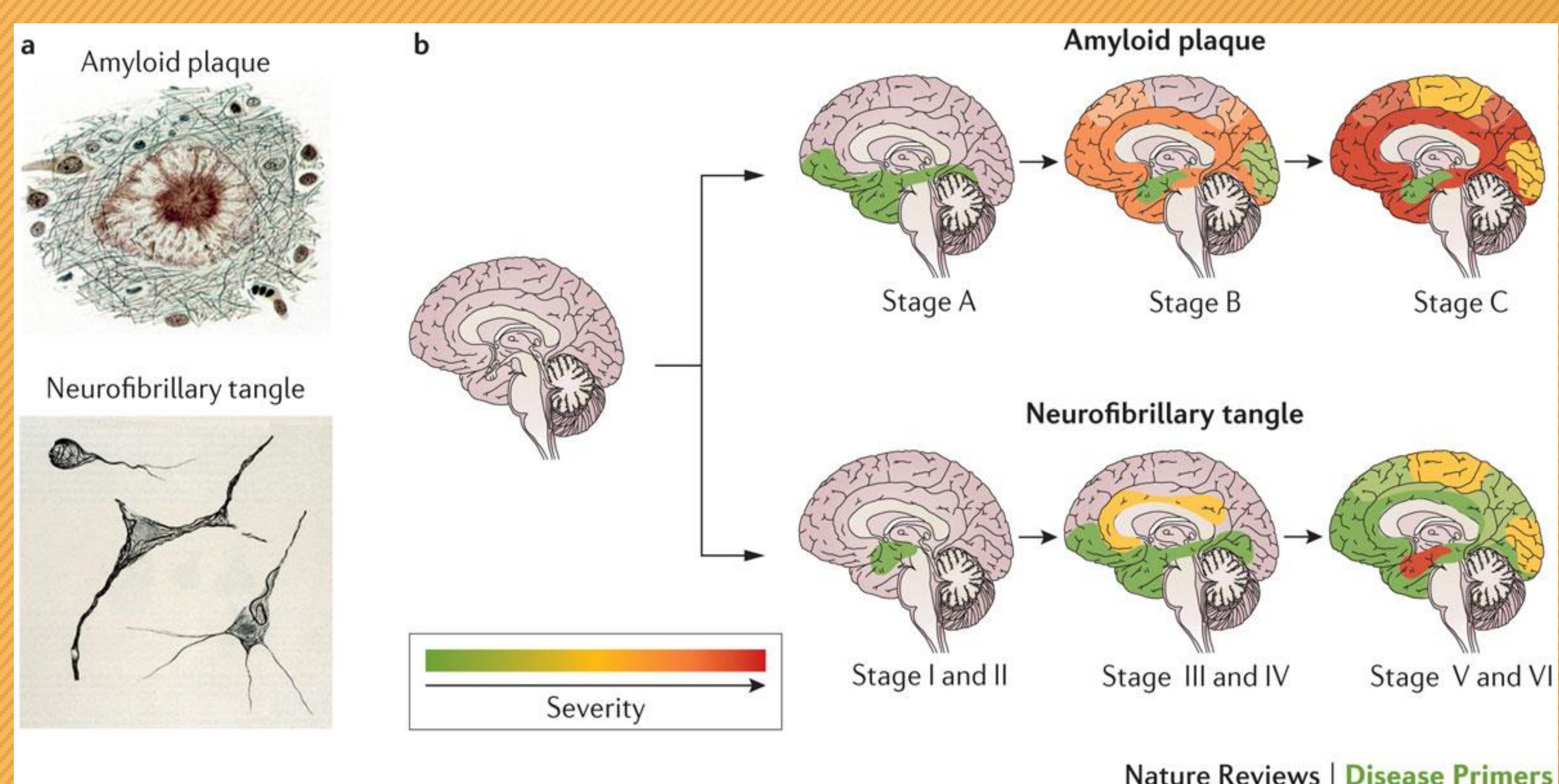


Figure from Masters, C.L. (2015)

