

“Everything is Everywhere”: Determining Population Structure of Northeastern *Dictyostelium discoideum*

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Abstract

Background:

- Genetically influenced social behaviors allow researchers to draw connections between an organism's genetic makeup and their behavior.
- Analysis of gene variability across genetic populations and geographical locations provides useful information, allowing researchers to assess gene flow and the effect of natural selection on allele frequencies.

Model Organism: The social amoeba, *Dictyostelium discoideum* (Dicty)

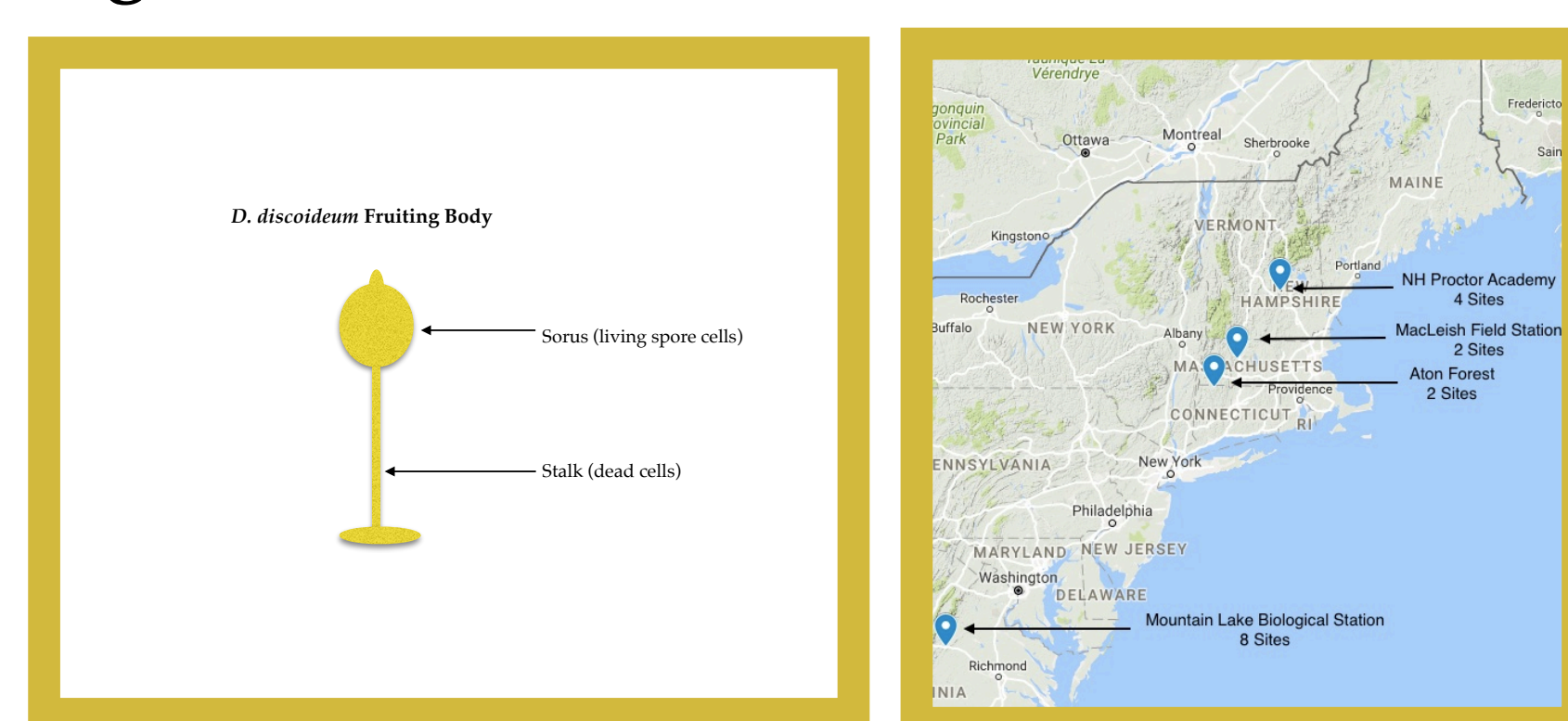
- Facing starvation, Dicty eventually differentiates into two types of cells: pre-spore and pre-stalk [1].

- A mutation in the cheater C (*chtC*) gene causes cheating through allocation of fewer cells to the stalk, thereby reaping advantages and experiencing lower cost than the wild-type. A mutation in a gene called *rccA* (resister of *chtC* A) confers resistance to cheating by the *chtC*-mutant [2].

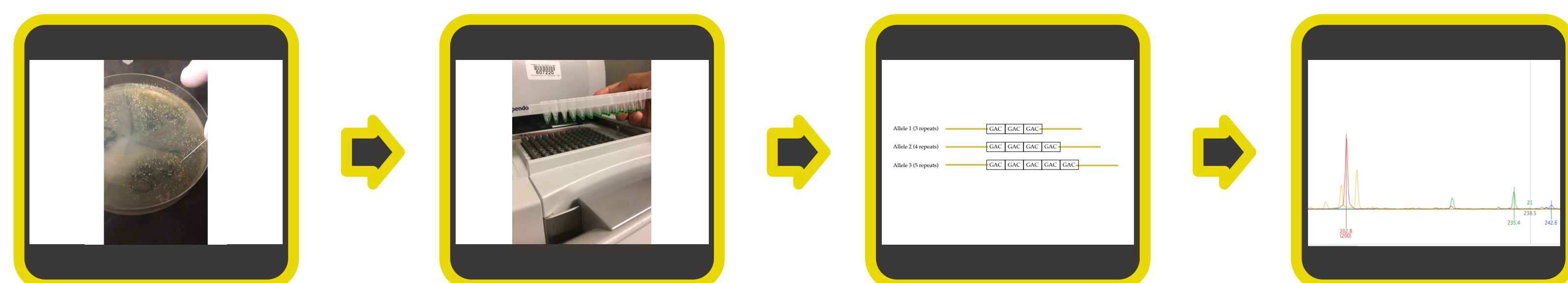
Approach: I investigated the variability of 6 loci including *rccA* in ~300 natural isolates using microsatellite analysis. I found that many alleles were present across loci and geographical locations.

Methods

Figure 1



Dicty creates a fruiting body as stalk cells altruistically give up their lives so that the spores (10,000+ cells) can disperse and carry on their genetic material (left). Isolates were collected from 10 cm x 10 cm plots in several locations (right).



Development:

Cryogenically frozen Dicty strains were grown up on petri dishes of standard media and bacteria.

Extraction & PCR:

The DNA was extracted using Chelex and amplified using fluorescently tagged primers.

Microsatellites:

Microsatellites are areas in the genome made of short repeat units. Different numbers of repeats represent alleles.

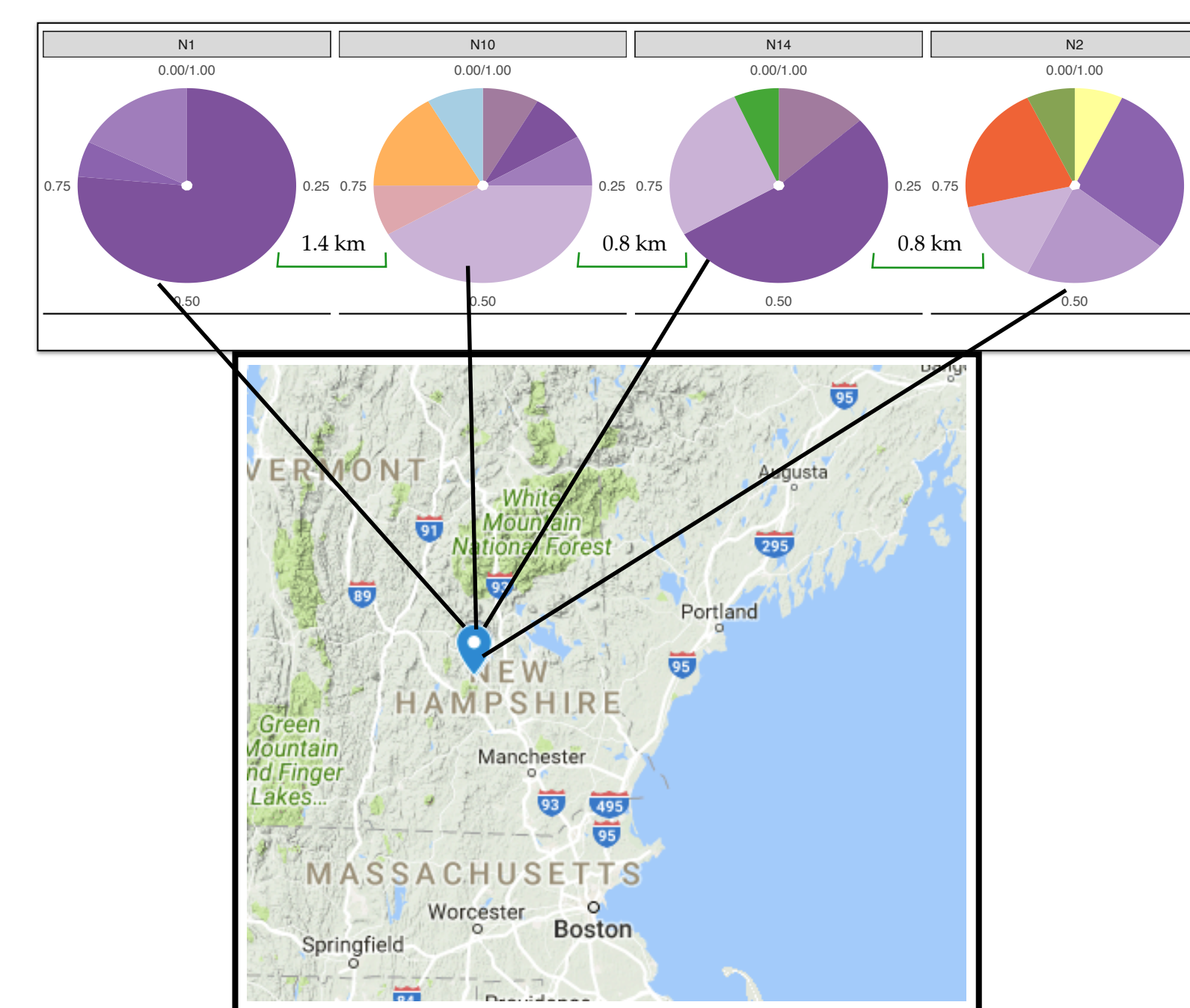
Capillary Gel Electrophoresis:

Colored peaks represent different amplicons. X-axis is the amplicon size, Y-axis is the brightness of the band.

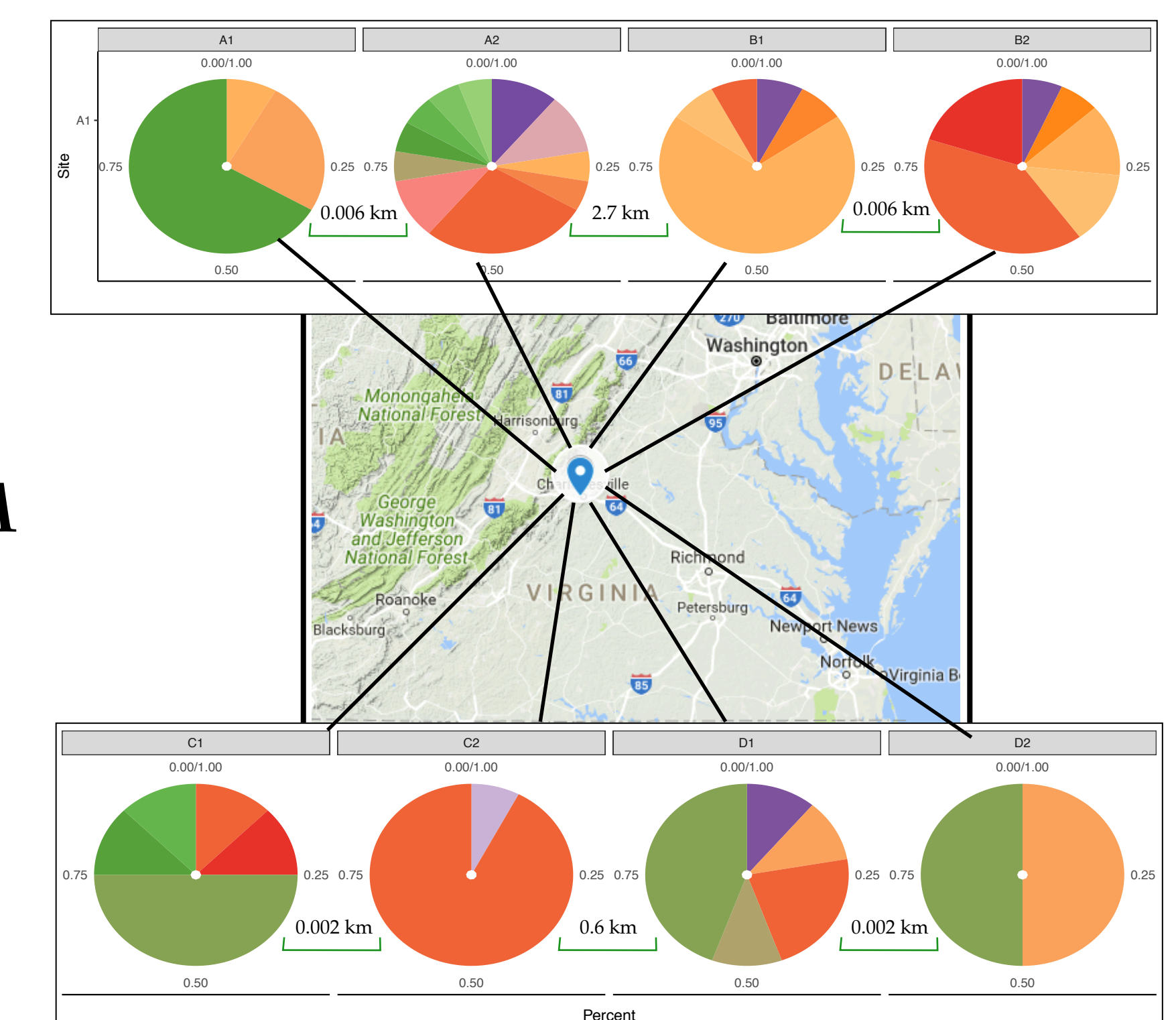
Results

Many Alleles Seen Across Loci & Geographical Locations

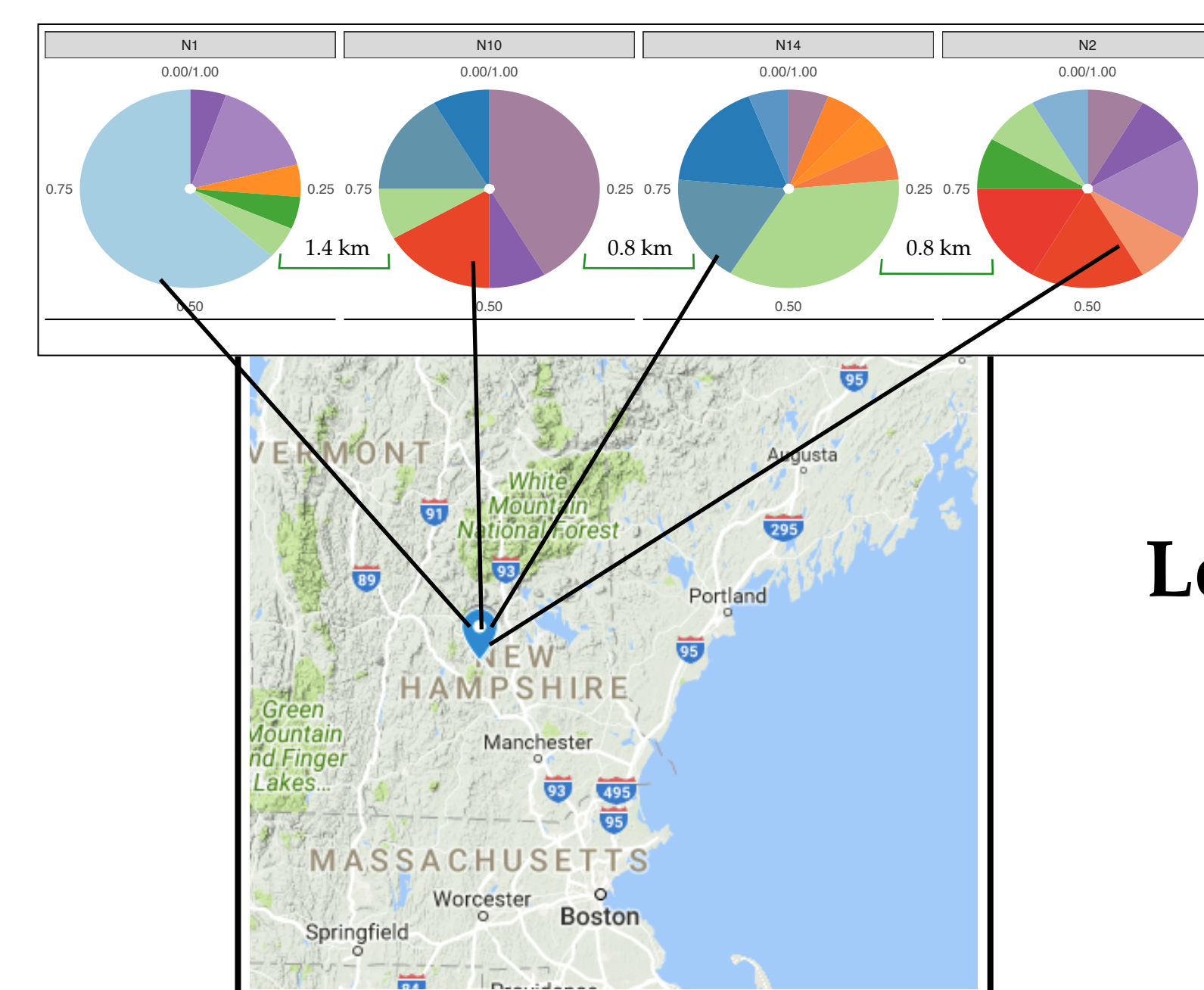
New Hampshire



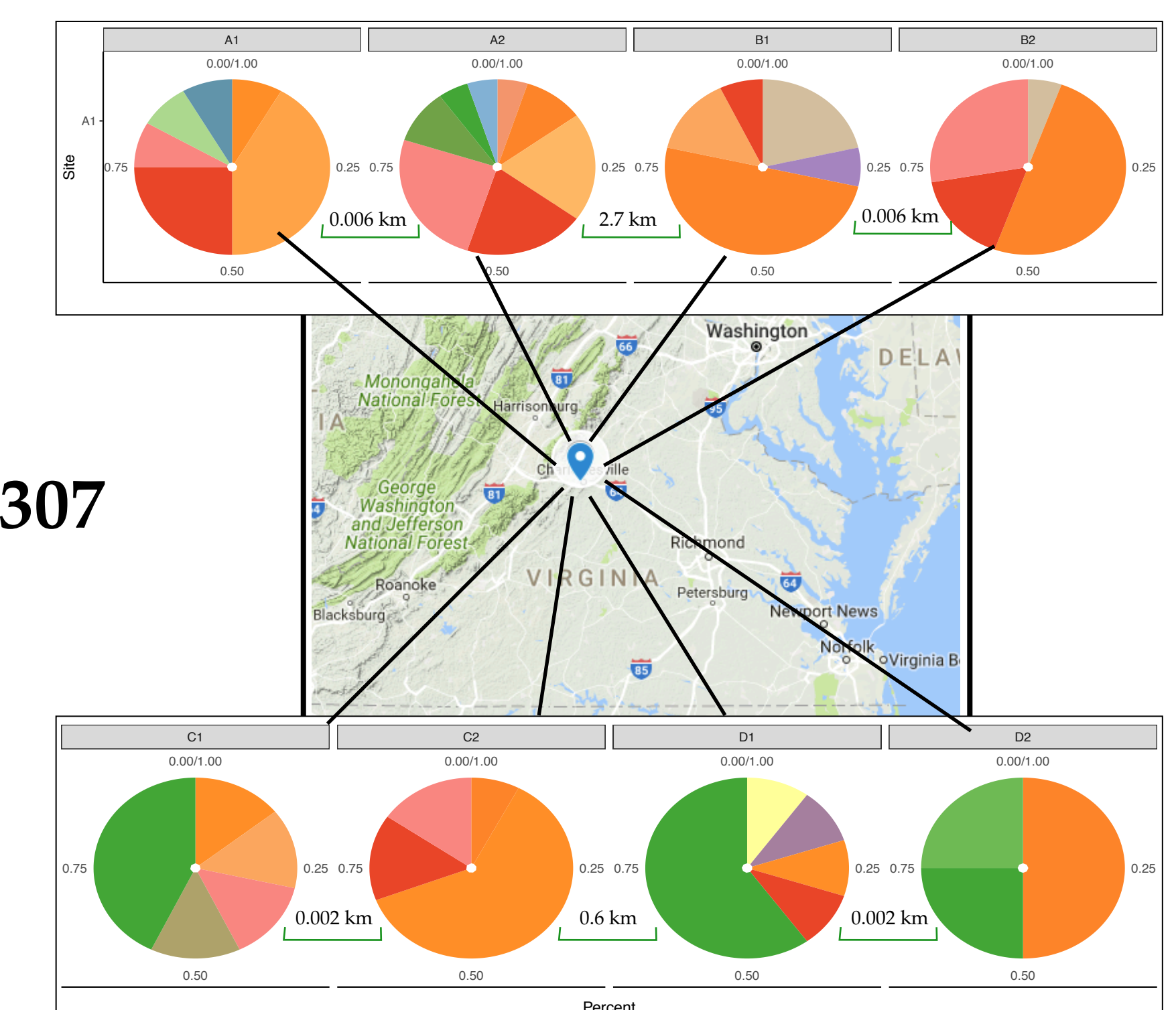
Virginia



rccA

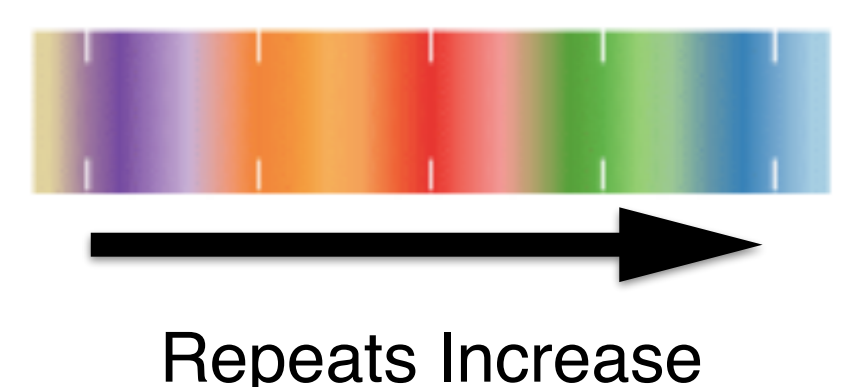


Locus 307



Discussion

- Colors represent unique alleles per locus. Each allele has a different microsatellite repeat number.
- Numbers within green brackets between pie charts represent distance in km from one site to the other.
- Even across state lines, loci have some of the same alleles, while sites only a few km from one another have some unique alleles.
- Using genetic variation analysis, we can identify and differentiate populations.



Repeats Increase

References:

- Fortunato A., Strassmann J., Santorelli L., Queller D. *Co-occurrence in nature of different clones of the social amoeba, Dictyostelium discoideum*. Molecular Ecology, Vol 12. 2003.
 - Khare A., Santorelli L., Strassmann J., Queller D., Kuspa A., Shaulsky G. *Cheater-resistance is not futile*. Nature, Vol 461. 2009.
- Acknowledgements: Biology of Behavior Institute, Scott Bingham, DNALab ASU