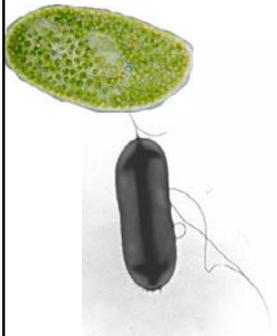
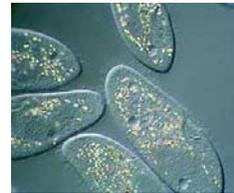
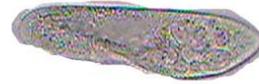


# Culturing Wee-beasties for Mathematical Modeling

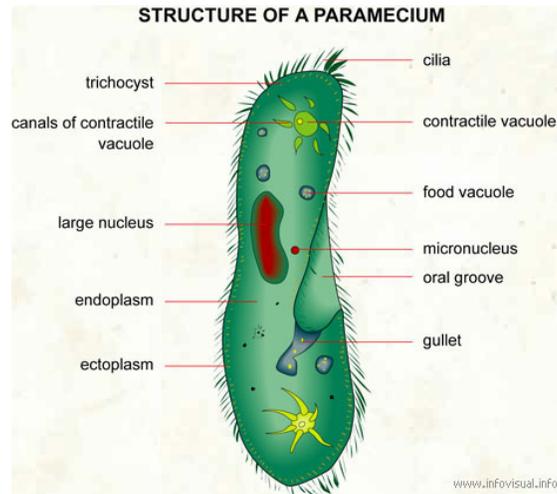


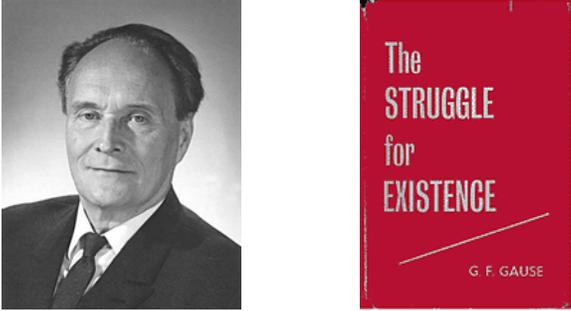
*Paramecium*  
and  
*Bacteria*



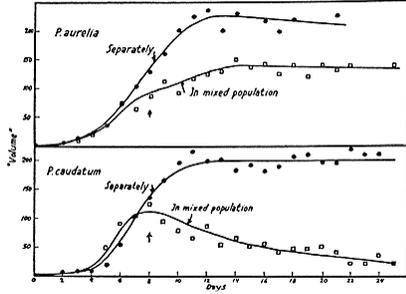


## The World of *Paramecium*

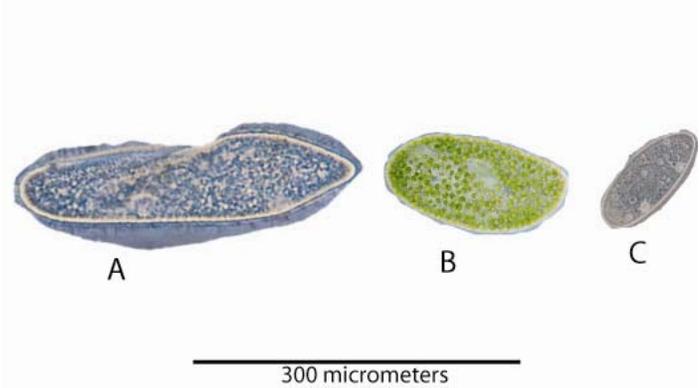




The STRUGGLE for EXISTENCE  
G. F. GAUSE



The graph illustrates the results of Gause's experiments on competitive exclusion. The y-axis represents the percentage of volume, and the x-axis represents time in days. Two species are compared: *P. aurelia* (top panel) and *P. caudatum* (bottom panel). For each species, two conditions are shown: 'Separately' and 'In mixed population'. In the 'Separately' conditions, both species reach a stable carrying capacity. In the 'In mixed population' conditions, *P. aurelia* outcompetes *P. caudatum*, leading to the extinction of *P. caudatum* in the mixed population.



A 300 micrometers

A. *P. caudatum*  
B. *P. bursaria*  
C. *P. aurelia*

The image shows three micrographs of Paramecium cells. A is *P. caudatum*, a large, elongated cell with a distinct oral groove. B is *P. bursaria*, a smaller, more rounded cell with a greenish internal structure. C is *P. aurelia*, a small, oval-shaped cell. A scale bar below the micrographs indicates 300 micrometers.

## Procedures – Stock Populations

- Start stock populations with ~200mL of **spring water** in a wide mouthed jar (2 jars per species).
- Add approximately ½ of the Carolina stock vial to on jar for that species. Repeat for the second jar.
- Place two wheat seeds in each jar.
- Cover the mouth of the jars with a piece of cheesecloth secured by a rubber band.
- After the populations begin to settle, increase the volume of the habitat to 400 mL.
- Add additional water to the jars when needed.
- If it appears that too much algae or bacteria is building up in a jar, filter the population into a new clean jar using a piece of cheese cloth as the filter.





## Population Growth

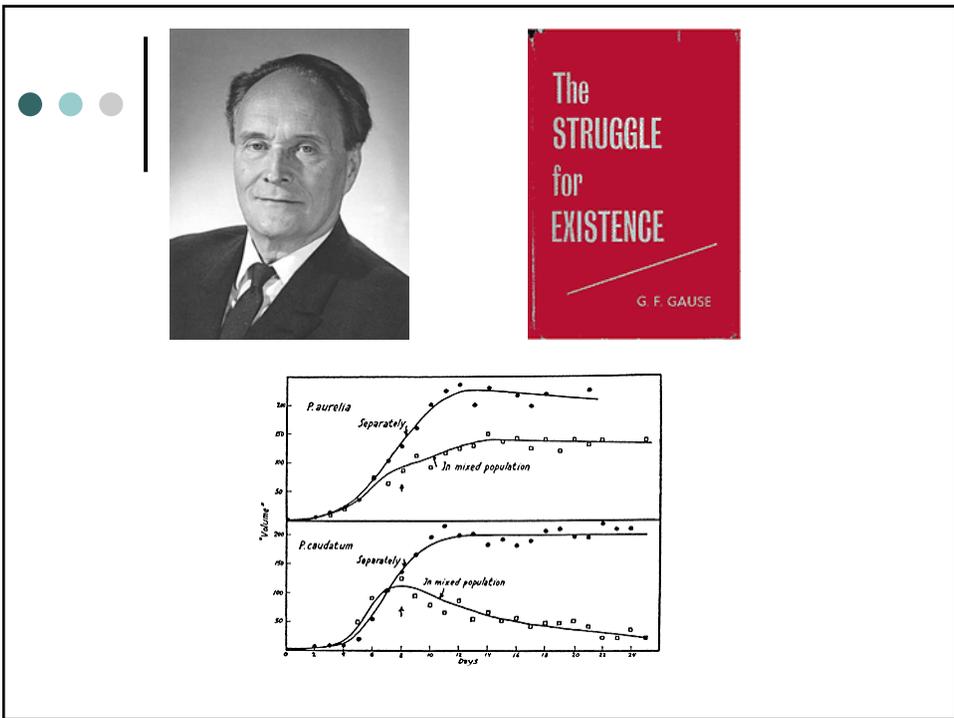
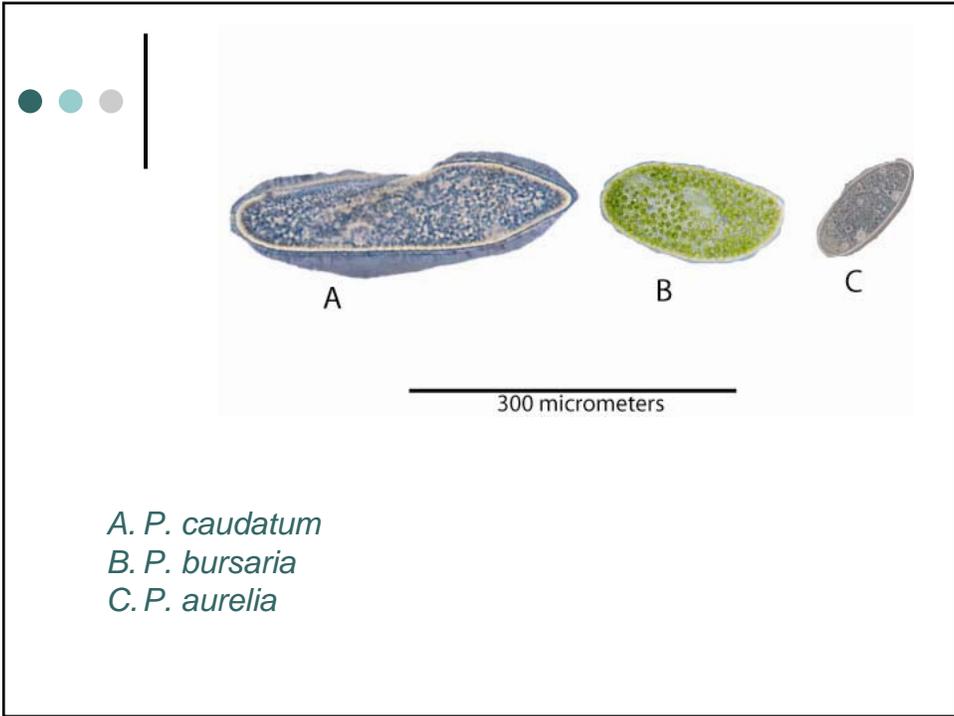
- Use the concentration of the stock population to be used to seed the experiment to calculate the volume needed to obtain 800 individuals.
- Pipette this volume of the stock into a small, flat bottomed test tube and dilute to 20 mL.
- Use the above procedure to conduct population counts and observe the changes in population size for at least two weeks.



## Counting...harder than you might hope



- Set a digital pipette to measure out 100  $\mu\text{L}$ . Put a tip on the pipette and cut part of the narrow end of the tip off (2-3 mm).
- Swirl the jar to homogenize the population.
- Take four samples of 100  $\mu\text{L}$  each
- Use a dissecting microscope to view each cell. Visually determine the number of individuals present in the cell and record your data.
- If the population becomes so dense so as to make it difficult to get an accurate count reduce the sample size to 50  $\mu\text{L}$  or even as low as 25  $\mu\text{L}$ .





## Competition between 2 species

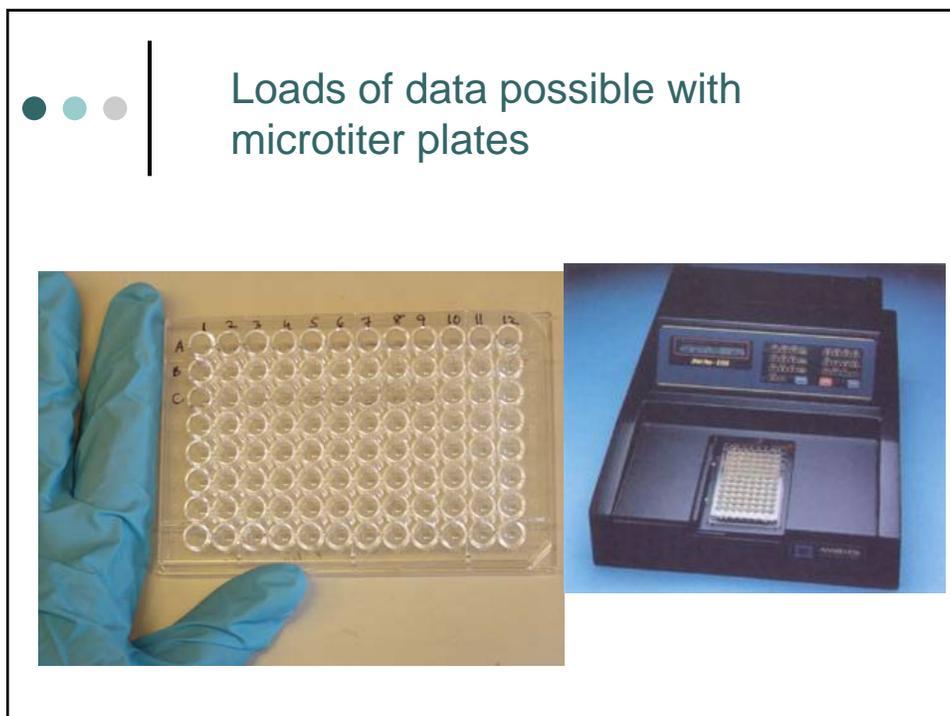
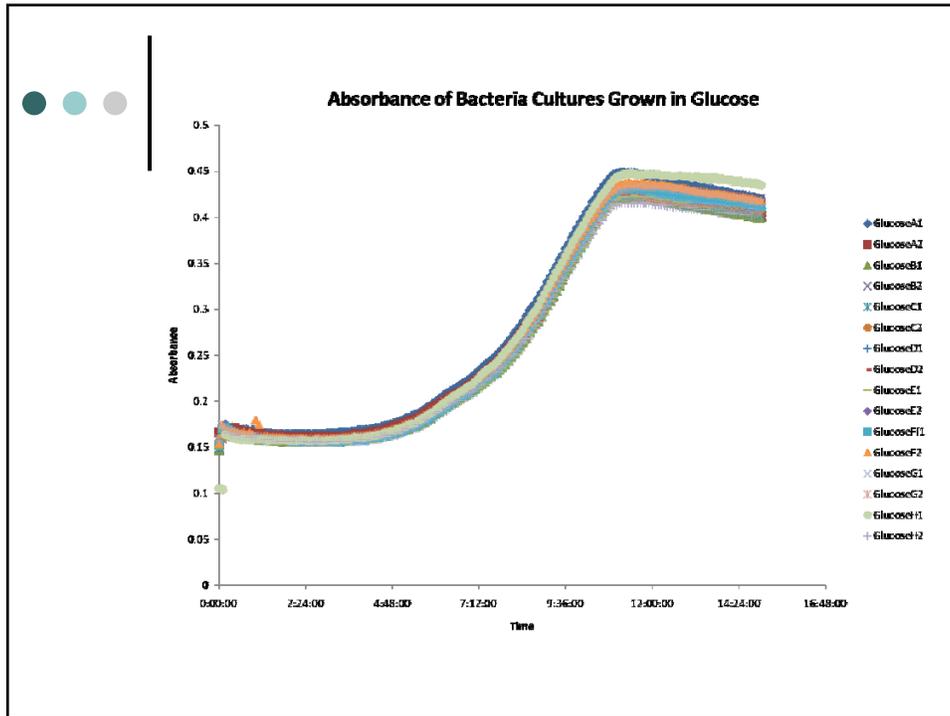
- Use the concentration of the stock population to be used to seed the experiment to calculate the volume needed to obtain 800 individuals.
- Pipette this volume of the stock into a small, flat bottomed test tube and dilute to 20 mL.
- Use the above procedure to conduct population counts and observe the changes in population size for at least two weeks.



## Working with Bacteria (briefly)

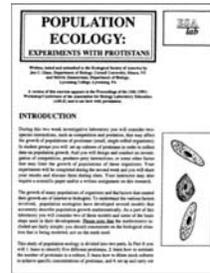
- Seed culture with *E. coli* in culture medium
- Incubate at 37°C
- Measure “Optical Density” every 30 mins







## Important Resource for Protists from Ecological Society of America



- o [http://tiee.ecoed.net/vol/expv1/expv1\\_toc.html#3](http://tiee.ecoed.net/vol/expv1/expv1_toc.html#3)
- o David Ribble (dribble@trinity.edu)