#### Lecture 14

Genetic Drift (Article 14) Please pick up 2 pennies as you come in!





- Extrinsic factors (e.g., fluctuating environment)
- ⇒Intrinsic factors, or sampling error
  - In population modeling, we assumed 'b' and 'd' were deterministic.
  - ⇒In the "big bang" life history (H-W), we assumed a large (actually N=∞) population of parents



#### Genetic Drift – Genetic Stochasticity →Genetic Drift - allele frequency change due to

small N (and resulting sampling error ) →How will allele frequency change?

Model involves intensive probability theory: you have 2N alleles combining at random, the probability that i of them will be A<sub>1</sub> is given by the binomial distribution;

# Experimental Demonstration of Genetic Drift (Using Clickers!)

- **Experiment 1:** Infinite Population.
- →Assume p=0.5, q=0.5
- ➡What would p<sub>t+1</sub> be after one generation of drift with N=infinity?

Expt'l Demo of Drift 2. N=X (Class size today). Flip your two coincu what in 'unior's constant?									
	Genoty	be: (A)	(B)	(C)	p	q			
		HH	HT	ΤT					
	Observe	d							
	Expecte	d .25	.50	.25	.5	.5			





Expt' 1 Demo of Drift									
198	►N=8								
	Genot	ype: (	A) HH	(B) HT	(C) TT	р	q		
	Obser	ved							
	Expec	ted .	25	.50	.25	.5	.5		
	<u>.</u>								

 Expt'l Demo of Drift →N=8 (trial 2)									
Genotype:	(A) HH	(B) HT	(C) TT	р	q				
Observed									
Expected	.25	.50	.25	.5	.5				
	•	•			<u> </u>	L			



Ez X popula	xpt'1	Demo ith N=1 # of Pop'ns	of Dr	ift	
Time	(A) HH	(B) HT	(C) TT		
1	(p=1)	(p=.5)	(p=0)		
1					
2					
3					
4					





➡Genetic drift is allele frequency change without a <u>directional</u> driving force:

## Genetic Drift - A Random Walk

By chance, in the absence of other forces, all small populations will drift to fixation : p=0 or p=1.

#### Genetic Drift and Small Populations

- ➡Genetic drift results in most rapid allele frequency change in small populations
- Rare plants and animals will tend to lose genetic variability

➡Is drift <u>unimportant</u> in large populations?

\*\*\*\*\*\*Not necessarily!\*\*\*\*\*

# Effective Population Size Individuals often mate within a small neighborhood, making N *effectively small* (and therefore drift becomes a potent force)



# Population Bottlenecks Due to effects of stochastic factors on population size, the stochastic process of drift can reduce genetic variation in low N periods

### Genetics of Turtles

- »Demonstration of population bottleneck
- ■GG=Dark Green Turtles
- ➡Gg=Dark Green Turtles
- →Gg=Light Green Turtles

#### Summary-Genetic Drift

- ➡Genetic drift is allele frequency change due to 'sampling error'
- Drift results in fixation of one allele or the other
- The rate of fixation is N-dependent, with fastest rates of change occurring in small populations
- A population bottleneck is a historical phenomenon that produces drift-like loss of genetic variation and differentiation