Population genetics lab

Attendance Code

What we will do today

1. Reminder of Hardy-Weinberg Equilibrium
2. Example of Hardy-Weinberg Equilibrium
3. Class exercise 1 (with marbles)
4. Class exercise 2 (with table)
5. 10 minute break
6. Class exercise 3 (more marbles)
7. Overview of assignment
8. Conclusion

Reminder of Hardy-Weinberg Equilibrium

$$p^2 + 2pq + q^2 = 1$$

- No natural selection
- No mutation
- No migration (no gene flow)
- Infinite population size
- Mating is random
- Non-overlapping generations

Example of Hardy-Weinberg Equilibrium

Test HWE using 3 genotypes from 1000 UK residents

Genotype	MM	MN	NN	Total
Counts	298	489	213	1000

Are observed frequencies at the MN locus in accord with those expected under HWE?

First find Freq(M) = p, and Freq(N) = q

Example of Hardy-Weinberg Equilibrium

Genotype	MM	MN	NN	Total
Counts	298	489	213	1000

Example of Hardy-Weinberg Equilibrium

Class exercise 1 (with marbles)

Black (B), Clear (b)

- BB:
- Bb:
- bb:

Allele frequencies?

Class exercise 1 (with marbles)

Black (B), Clear (b)

- BB:
- Bb:
- bb:

HWE genotype frequencies?

Microsatellites

- Repeated DNA sequences
- Alleles are repeats
  - 'GTGT' (2)
  - 'GTGTGTGT' (4)
  - 'GTGTGTGTGT' (5)
- Neutral variation

Class exercise 2 (with table)

Sample	Allele 1	Allele 2	Genotype
1	121	125	Bb
2	121	121	BB
3	121	121	BB
4	125	125	bb
5	121	125	Bb
6	125	125	BB
7	121	121	bb
8	121	125	bb
9	121	125	Bb
10	121	125	Bb
11	125	125	bb
12	121	121	BB
13	121	121	BB
14	121	125	Bb

BB: 5

Bb: 5

bb: 4

Allele freqs?

Genotype freqs?

HWE freqs?

10 minute break

Take a break!

Class exercise 3 (more marbles)

Black (A_1), Clear (A_2), Yellow (A_3)

- A_1A_1:
- A_1A_2:
- A_1A_3:
- A_2A_2:
- A_2A_2:
- A_3A_3:

Allele frequencies?

Class exercise 3 (with marbles)

Black (A_1), Clear (A_2), Yellow (A_3)

- A_1A_1:
- A_1A_2:
- A_1A_3:
- A_2A_2:
- A_2A_2:
- A_3A_3:

$$\mathrm{Fr}(A_1) = p, \quad \mathrm{Fr}(A_2) = q, \quad \mathrm{Fr}(A_3) = r$$

Class exercise 3 (with marbles)

- $\mathrm{Fr}(A_1) = p$:
- $\mathrm{Fr}(A_2) = q$:
- $\mathrm{Fr}(A_3) = r$:

Class exercise 3 (with marbles)

- $\mathrm{Fr}(A_1) = p$:
- $\mathrm{Fr}(A_2) = q$:
- $\mathrm{Fr}(A_3) = r$:

$$p^2+q^2+r^2+2pq+2pr+2qr = 1$$

Class exercise 3 (with marbles)

- Allele frequencies?
- Observed genotype frequencies?
- Expected genotype frequencies?
- In Hardy-Weinberg Equilibrium?

Overview of assignment

- Freshwater crustaceans (*Daphnia pulex*)
- In European ponds and lakes
- Asexual & sexual reproduction
- Sampled high radiation Chernobyl zone
- Microsattelite data

Overview of assignment

- Count 152 & 152: 22
- Count 152 & 144: 3
- Count 152 & 148: 2
- Count 144 & 144: 0
- Count 144 & 148: 0
- Count 148 & 148: 0

Overview of assignment

- Count 152 & 152: 22
- Count 152 & 144: 3
- Count 152 & 148: 2
- Count 144 & 144: 0
- Count 144 & 148: 0
- Count 148 & 148: 0

- Freq(152) = p
- Freq(144) = q
- Freq(148) = r

Allele Frequencies

Allele	Number	Frequency
p (152)		
q (144)		
r (148)		

Overview of assignment

Genotype frequencies

Genotype		Expected	Observed
pp	p^2		
qq	q^2		
rr	r^2		
pq	$2pq$		
pr	$2pr$		
qr	$2qr$		
	Sum:		

Observed heterozygosity (H_O):

Expected heterozygosity (H_E):

Conclusion

- Complete Parts 3-5
- Will have 4 alleles