BIS101 F2013 Lecture 2: Mendel

Notes from last time

Tga1/tga1 like A/a

Side board hard to see -- yell or raise a hand.

Questions, just ask, raise a hand!

Homework due at beginning

Papers are on smartsite or linked

Genotype vs. phenotype -- always keep in mind which we are talking about. Genotype ratios will diff. from phenotype ratios.

Dash vs. minus for phenotypes

Mitochondrial replication genes are mitochondrial, control of when the replicate can be nuclear.

Questions?

Questions on lecture from yesterday?

Mendel's First law: Equal segregation (which is?) Example: Ch. 2 # 41

```
In the plant Arabidopsis thaliana, a geneticist is interested in the development
of trichomes (define). A large screen turns up two mutant plants (A and B) that
have no trichomes, and these mutants seem to be potentially useful in studying
trichome development. Each plant is crossed with wild type; in both cases, the
next generation (F1) had normal trichomes. When F1 plants were selfed, the
resulting F2's were as follows:
F2 from mutant A: 602 normal; 198 no trichomes F2 from mutant B: 267 normal; 93
no trichomes.
```

Draw hairy WT, and glabrous normal. Show F1 and F2. Ask phenotype of F1 (can't know! b/c mutant could be het. for dom. allele).

```
a. What do these results show? Include proposed genotypes of all plants in your
answer.

b. Under your explanation to part a, is it possible to confidently predict the
F1 from crossing the original mutant A with the original mutant B?
```

Mendel's Second Law:

Independent assortment ❓ Unlinked genes assort independently: what happens at one locus, stays at one locus.
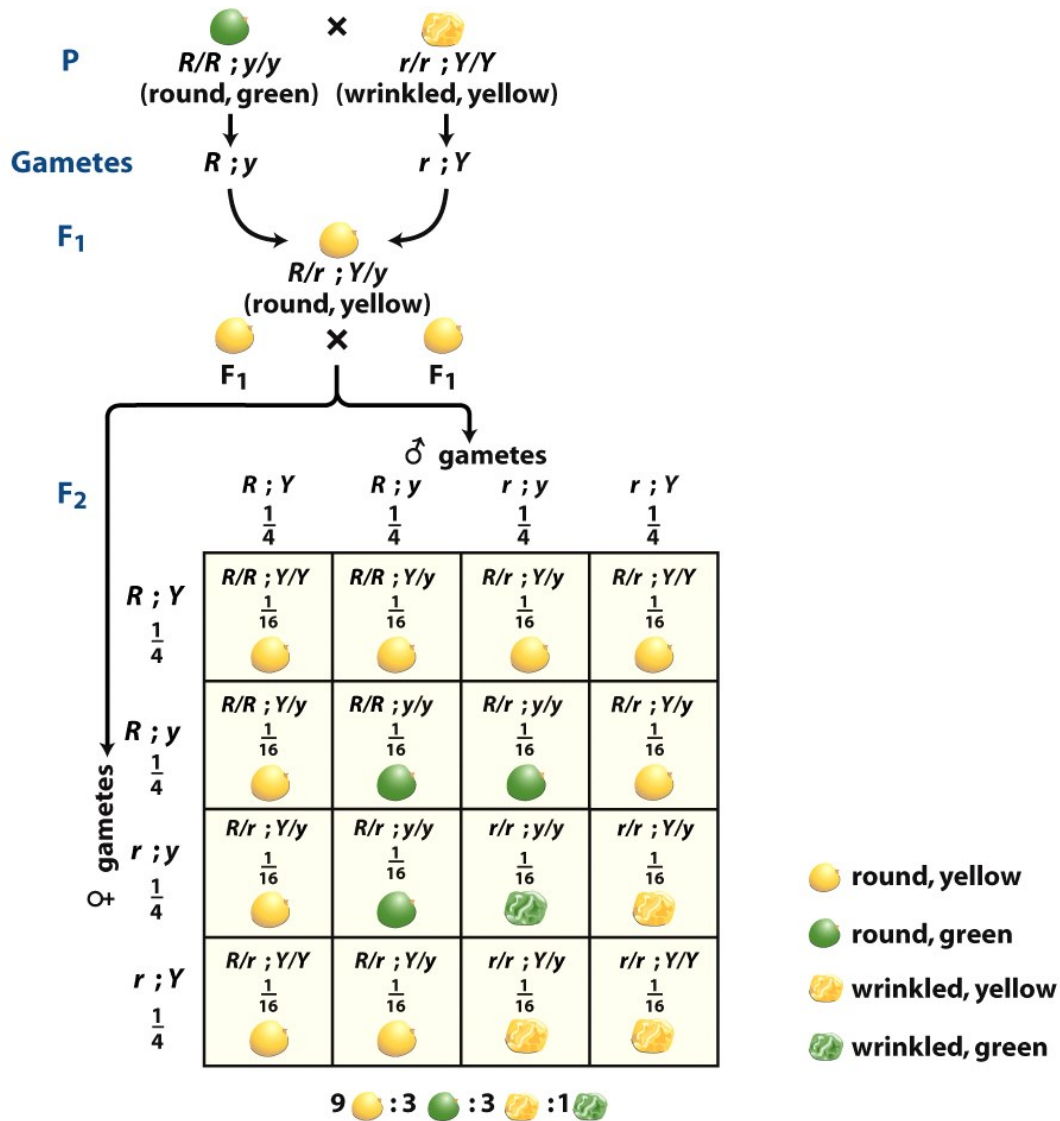
Work through example.

Figure 3-4
Introduction to Genetic Analysis, Tenth Edition
© 2012 W. H. Freeman and Company

- Describe parents phenotype.
- Ask gametes.
- Ask F1.

- Draw Punnett square.
- Get phenotypes.
- work out all 16 progeny, figure out phenotype based on dominant/recessive
- Show monohybrid 3:1 **❓** is this phenotype? for dominance or codom too?
- dihybrid 9:3:3:1 for phenotype
- for genotype more complex. how many diff genotypes? **❓** (3^2), most common is RrYy at 4 ways to get it.

Don't worry about Dihbyrid ratios with sex vs. autosomal loci

Chi squared

Reality never perfect, e.g. we see 267 vs 93 which we interpret as 3:1 (though not perfect 270:90). But would we interpret 280:80 or 290:70?

So how to know if close enough? Chi-squared test

I expect 270:90; i observe 267:93

Chi^2 = Sum((E-O)^2/E); compare to table with df (degrees freedom?)

df = here is number of phenotypic classes -1 (here 2 classes so 1 df) don't worry about how to calculate df.

sum = 0.13, 1 df, from table 3-1 in book, to be significant at p=0.05 (i.e. <5% chance of observing data) need 3.841.

❓ so what do you conclude? (can't reject null hypothesis of expectation, != to saying it is right!), that is 3:1 is an OK way of describing this

redo yourself with 244:104. **❓** If 3:1 is correct, what is predicted numbers? 261:87 should show the predicted ratio for 3:1 is: 261:87

value is 4.43 -> reject 3:1 ratio!

Can use for equal segregation (numbers of big A and a in offspring from one locus, association among loci, population genetics, etc.)

will return to Chi-squared for other things in the future.

Predictions: probability

Useful for studying pedigress, for knowing proportions of offspring, gamete production, etc.

Product rule:

For independent events -> multiply

❓ Chance of rolling a 2 on a die? 1/6

? Of rolling a 2 then a 5? 1/6*1/6 = 1/36

- AaBb chance of getting an ab gamete? 1/4!
- **?** Chance to get aBcd from AaBbCcDd -> 1⁄2^4 = 1/16

Example: (save on board)

tb1-wt/tb1-ref;Wxy/wxy;adh1/adh1; **?** Which is dominant? (i didn't say)

? If I self, what's the chance of getting a tb1-ref/tb1-ref;wxy/wxy;adh1/ adh1 ?

(1⁄2*1⁄2)*(1⁄2*1⁄2)=1/16=6.25%

? What's chance of getting tb1-ref/tb1-ref;wxy/wxy;adh1/Adh1 (0 unless mutation)

Addition rule: For mutually exclusive events (can't both happen)

- you can add
- chance of getting A or a from AaBb (1) chance of getting AB, Ab, aB, or ab ? (1)

Complement rule:

P(A)=1-P(not A)

So prob. of getting two heads = 1/2 * 1/2 = 1/4.

Prob. of not getting two heads = 3/4

Conditional probability

- Pr{A|B} read as A given B

*Example:

In a monohybrid cross with bob1 > bob2 (bob2 allele makes large thumbs) what's probability of genotype bob1/bob2 given WT thumbs?

- Pr(bob1/bob2 | bob1/-) = 2/3
- So *given* that I have the dominant phenotype prob het = 2/3

? What's prob of het w/o conditioning? (1/2)

Hard problem

How many progeny will i have to grow to get the tb1-ref/tb1-ref;wxy/wxy;adh1/ adh1 from example above @ 90% certainty?

- Subtract from what's easy to calculate (complement rule). Easy here to say what's prob

of never seeing progeny?
- **?** What's probability of not getting progeny i want (15/16) in first seed
- **?** What's the probability of getting my progeny if I grow 3 plants?
  - $1-(15/16)^3=17.6\%$
- **?** what if I grow n plants?
  - $1-(15/16)^n$
- So to get 90% certainty, I solve:
  - $1-(15/16)^n=0.9$
  - $(15/16)^n=0.1$
  - $n(\ln(15/16))=\ln(0.1)$
  - $n=\ln(0.1)/\ln(0.9375)=35.7 == 36$ plants