Class 11 9/18/17
Mendelian Genetics

- Announcements: **EXAM 1 9/20 (Classes 1 – 10)**
- Class administration
- Check iLearn for suggested problems
- Office hours HH668C:
  - Mon 2 – 4pm **TODAY**

EXTRA OFFICE HOURS TOMORROW
TUE 9/19, 4:30 - 6pm in HH525

i>clicker

or

- ❑ Did you bring your clicker remote today? GREAT!!
- ❑ Please check iLearn for your clicker score in gradebook (Should now see only "**Sessions 1, 2, & 3**")
- ❑ If your clicker score is missing, please e-mail me your clicker remote ID.

EXAM 1 WED 9/20

"Mr. Osborne, may I be excused? My brain is full."

- All students must take the exam in the Section they are enrolled in
- Exam 1 (covers content of Classes 1 – 10)
- Bring PEN to exam (**no pencils**)
- Bring simple calculator for this exam--NOT cell phone or laptop or tablet
- **Bring YOUR Photo ID**
- DO NOT bring scantron form or blue book
- ARRIVE EARLY, so that we can distribute exams and you can start at 10 minutes after the hour

seminar

Tuesday, 9/19/17
HH 543, 2:10pm

Biol 572/872 Ecology, Evolution, & Conservation Biology Colloquium

http://biology.sfsu.edu/content/EEC

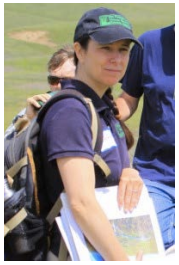
Robert Skelton
UC Berkeley
Drought responses in Californian mixed evergreen and deciduous oak woodlands

https://nature.berkeley.edu/dawsonlab/people/robert-skelton/

Romberg Tiburon Center Seminar Series

http://rtc.sfsu.edu/seminar/index.htm

Wednesday, 9/20/17
Bay Conference Center, 3:30PM



Sarah Ferner, SF Bay National Estuarine Research Reserve, and Richelle Tanner, SFSU & U.C. Berkeley

Ask me about climate change! A strategic approach to talking about climate change with the public

http://www.sfbaynerr.org/about-us/contact/

https://www.richelletanner.com/about

Biol 871 Colloquium in Microbiology, Cell & Molecular Biology

Thursday, 9/21/17
SCI 210, 2:10 pm

http://biology.sfsu.edu/content/MCMB

Ahna Skop
University of Wisconsin-Madison

The mystery and beauty of cell division

http://skoplab.weebly.com/

Product law

$0.50

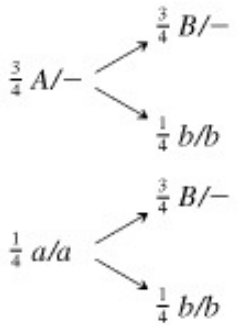
$50

- The probability of two independent events occurring at the same time can be calculated using the product law.
- For simultaneous outcomes (***AND***)
- The probability of both events occurring is the *product* of the probability of each individual event.
- When you flip two coins, there are four possible outcomes. What is the chance that you will get two heads (H **and** H)?
  - Chance of getting Head with first coin ($50) = ?
  - Chance of getting Head with second coin ($0.50) = ?
  - Probability of getting H **and** H = 1/2 x 1/2 = 1/4

- We used the **product law** when calculating probabilities by the forked-line method.

Product Rule of Probabilities

A/a;B/b x A/a;B/b



Can also use this approach to calculate probability of each genotype…

- The product rule
  - If the events of A and B are independent, the probability that they occur together is denoted

    P (A AND B) = P (A) x P (B)

Probability of A AND b phenotype

= P (A) x P (b)

= 3/4 x 1/4

= 3/16

Suggestion: Review fractions

$.50

Sum law

$1.00


- The sum law is used to calculate the probability of a generalized outcome that can be accomplished *in more than one way*.
- For outcomes that can occur more than one way (**OR**)
- The sum law states that the probability of obtaining any single outcome, where that outcome can be achieved in two or more events, is equal to the *sum* of the individual probabilities of all such events.

Flip a half-dollar and a dollar: what are the odds of 1 head and 1 tail?

Genetic Example

- What is the probability (p) of recovering dwarf, green, and wrinkled F2 progeny (*ddggww*) from a trihybrid cross?

- Parents: *DdGgWw* X *DdGgWw*
  - Possible gametes from one parent:
    - *DGW, DGw, DgW, Dgw, dGW, dGw, dgW, dgw*
    - so p(*dgw*) = 1/8
    - OR, can calculate it as
      - p(*dgw*) = p(*d*) x p(*g*) x p(*w*) = ½ x ½ x ½ = 1/8
- One *dgw* gamete must come from each parent
  - so p(*ddggww*) = p(*dgw* **and** *dgw*) = 1/8 X 1/8 = 1/64
- OR, can calculate as Dd x Dd, Gg x Gg, Ww x Ww
  - p(dd) x p(gg) x p(ww) = ¼ x ¼ x ¼ = 1/64

Conditional probability

- When one event depends on another, the likelihood of the desired outcome is the *conditional probability*.
- What is the likelihood that one outcome will occur, given a particular condition?
  - Answer = probability, p_c

- In the F2 progeny of Mendel's monohybrid cross between long and short plants, *what is the probability that a long plant is heterozygous?*

- ***condition***: consider only **long** F2 plants
- **question: of any F2 long plant, what is the probability of it being heterozygous?**

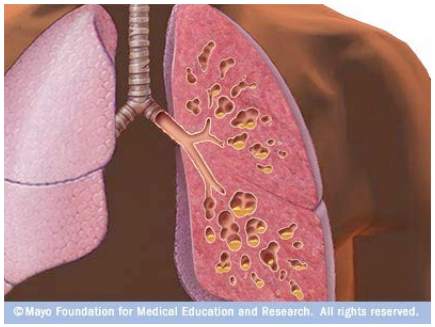
How do we solve for a conditional probability, p_c?

- Consider 2 probabilities:
  1) the outcome of interest (heterozygous), and
  2) the **condition** (long) that includes the outcome
- Back to example: In the F2 of Mendel's monohybrid cross between long and short plants, what is the probability that a long plant is heterozygous?
- 1) probability an F2 plant is heterozygous **p_a = 1/2**
- 2) probability of the condition, being long **p_b = 3/4**

$$p_c = p_a / p_b$$
$$= (1/2) / (3/4)$$
$$= (1/2) \times (4/3)$$
$$= 4/6$$
$$= 2/3$$

Applications for conditional probabilities: genetic counseling - 2

- LeVar and Letícia are "normal" (or "unaffected") parents with two young children:
  - One "normal" child, Kevin, and
  - One "affected" child, Sara, who has cystic fibrosis



- **What is the probability that Kevin is a carrier (a heterozygote)?**

http://www.mayoclinic.com/health/medical/IM04353

Applications for conditional probabilities: genetic counseling - 3

- **What is the probability that Kevin is a carrier (a heterozygote)?** or what is the probability that an unaffected sibling of a brother or sister expressing a recessive disorder is a carrier (a heterozygote)?

outcome of interest

p_a = probability that sibling is a heterozygote = 1/2
p_b = probability that sibling is unaffected = 3/4

$p_c = p_a / p_b = 2/3$

condition

Note that the probability that the unaffected sibling is **NOT a carrier is 1/3. [that is: 1 – 2/3 = 1/3]**

Even more chromosome terminology

- In diploid (2n) organisms, chromosomes occur in pairs, or homologs
- One homolog comes from each parent during fertilization

Human metaphase chromosomes and karyotype

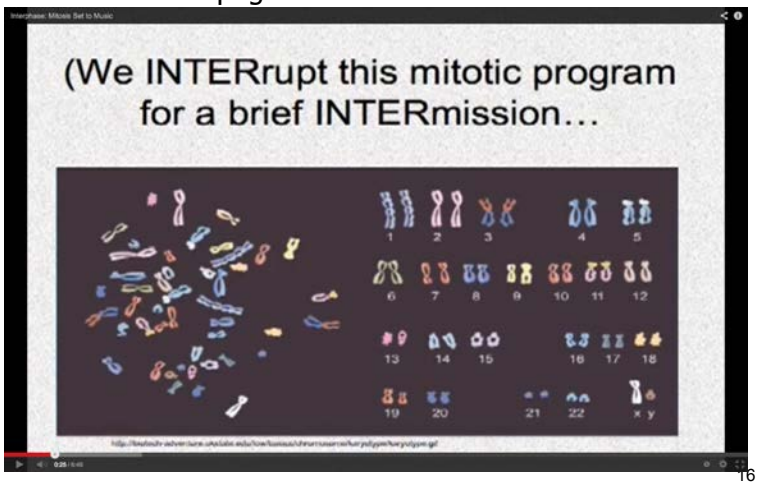
- After meiosis, gametes are haploid (n) and contain one member of each homologous pair, either a maternal or paternal chromosome

See Table 2.1 - Haploid number for different organisms

Figure 2.4

Interphase: Mitosis set to Music

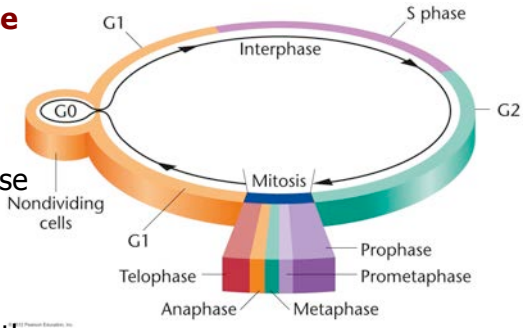
- Link on iLearn page



https://www.youtube.com/watch?v=ODwt6OdN-8Y

Eukaryotic Cell Cycle - 1

- **Mitosis** and **Interphase** (G1 - S - G2)
- **G1 phase**
  - cell mass increases
  - Preparation for S phase
- DNA is replicated during the **S phase** (DNA Synthesis)
  - Each chromosome in the interphase nucleus is duplicated, generating two sister chromatids



- **G2 phase**
  - Growth
  - preparation for mitosis

Figure 2.5

Eukaryotic Cell Cycle - 2

- **Mitosis** and **Interphase** (G1 - S - G2)
- **M phase** (Mitosis)
  - sister chromatids separate from each other and enter the newly forming daughter cells
  - karyokinesis followed by cytokinesis
  - each cell receives a sister chromatid from each chromosome

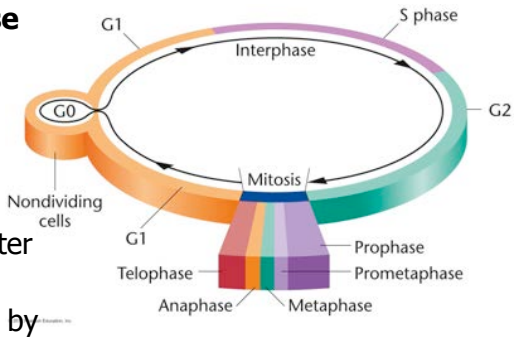


Figure 2.5