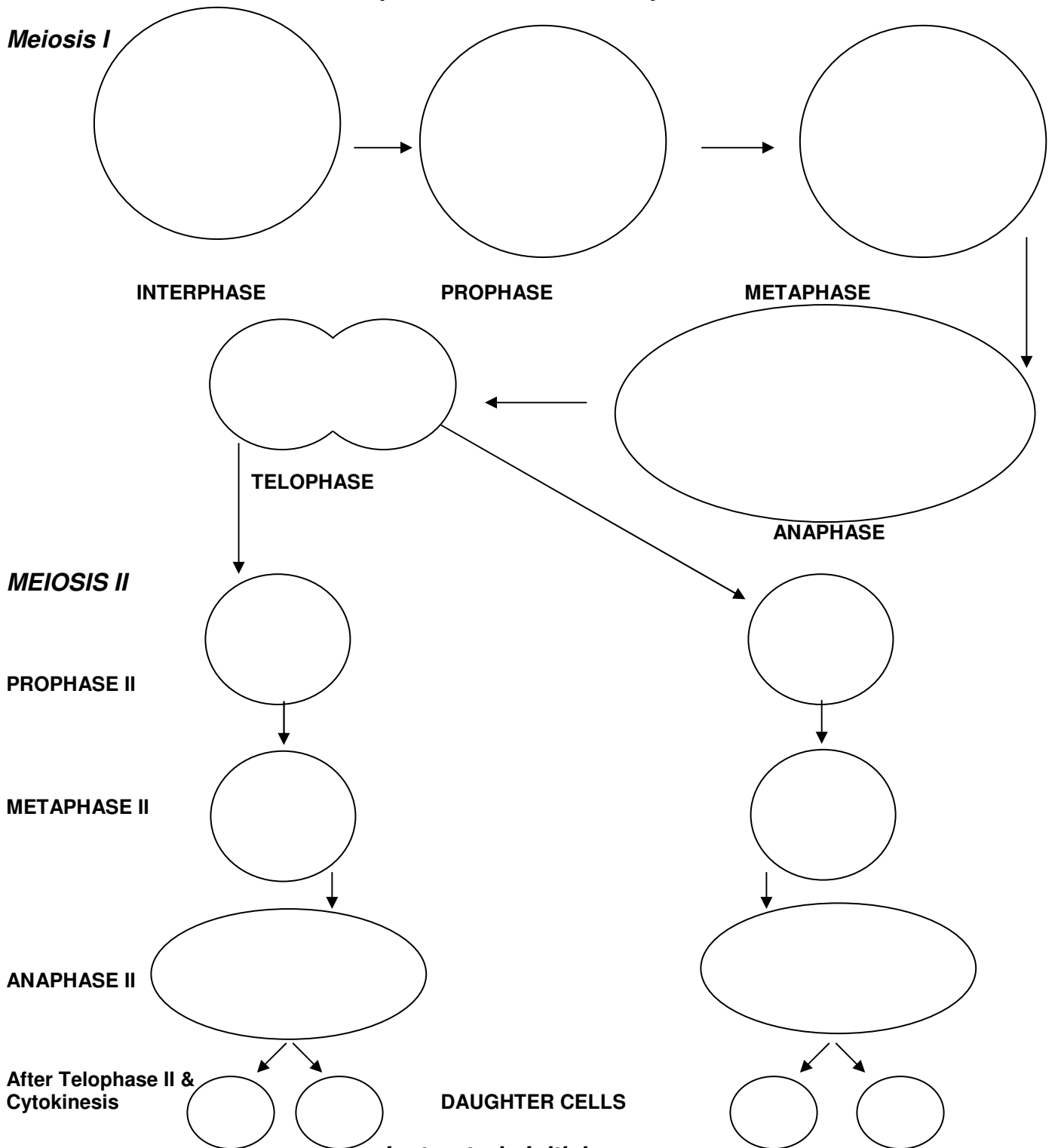


A. UNDERSTANDING MEIOSIS & CHROMOSOME SEGREGATION

1. **Meiosis activity:** Diagram the process of meiosis using the shapes provided below. Assume a diploid number of 4. Label completely. Use the color pencils to draw chromosomes (use one color for the paternal chromosomes and another color for the maternal chromosomes).

Meiosis tutorial -> <http://www4.ncsu.edu/unity/users/b/bnchorle/www/>



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2. Where in the human body does meiosis occur?
3. Which meiotic division is known as the reduction division?
4. What two sexual sources of variation occur during meiosis and how might these events affect the outcome of meiosis?

B. Importance of sample size in probability

5. Record the number of heads and tails for 100 coin tosses below and record your data on the computer in the classroom:
 Heads: _____ Tails: _____
6. Calculate the % deviation for your group's data using the equation from the written section. Show your work.

C. Chi-Square "Goodness of Fit" Test

Tables 1 - 3. Chi squared data table for personal, lab section and all coin flip data

	Observed	Expected
Heads		
Tails		

	Observed	Expected
Heads		
Tails		

	Observed	Expected
Heads		
Tails		

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7. Using Excel, graph the outcomes for a) your personal data set, b) your lab data set and c) the large data set (posted on the web).
8. Next, graph the p values against the log of the number of measurements. In a short paragraph discuss, once again, the effect of the number of measurements on the p value in these measurements. <http://www.graphpad.com/quickcalcs/chisquared1.cfm>

D.

9. You've decided to have a family. **Show your work below.**

a. What are the chances of having 3 boys in a row?

b. What are the chances of having 2 girls?

10. A couple has 6 children, 4 boys and 2 girls. What is the % deviation from what you expected according to probability? **Show your work.**

D. Types of Inheritance Patterns

11. Show all the different (unique) kinds of gametes which could be produced by the following individuals: (Remember 2^n where n = the number of pairs that are heterozygous)

a) bb

b) Rr

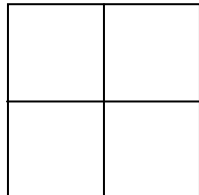
c) ddee

d) CcDd

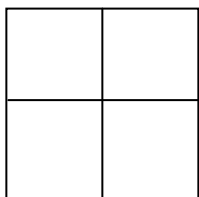
e) LLmmNn

12. In humans, normal arches are due to a dominant gene (A), flat feet are due to its recessive allele (a).

a) If a heterozygous normal arched individual mates with a flat footed individual, what type of offspring could be produced? **Show your work.**

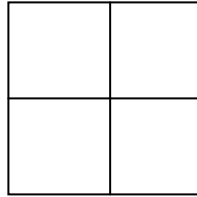


b) A normal arched male mates with a flat-footed female. The mother of the normal arched male had flat feet. What are the possible phenotypes and genotypes of this couples offspring?

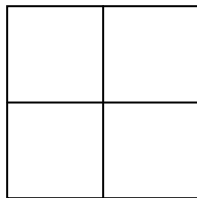


13. In the Japanese four o'clock flower, red flower (RR) color is incompletely dominant over white flower (rr) color; the heterozygous plants have pink flowers (Rr).

a) If a red-flowered plant is crossed with a white-flowered plant, what the genotypes and phenotypes of the plants of the F₁ generation?



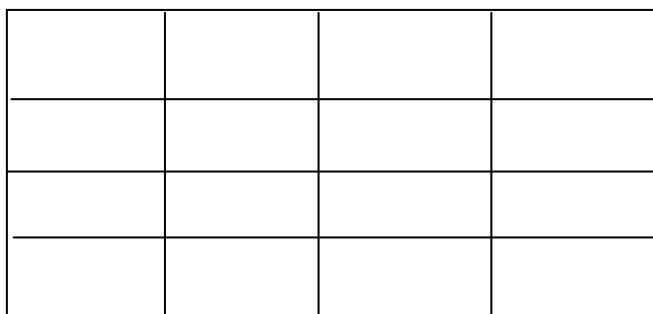
b) What kinds of offspring can be produced if a red-flowered plant is crossed with a pink-flowered plant?



14. In humans, the presence of freckles is due to a dominant gene (F) and the non-freckled condition is due to its recessive allele (f). Dimpled cheeks (D) are dominant to non-dimpled cheeks (d). Two persons with freckles and dimpled cheeks have two children: one has freckles but no dimples and one has dimples but no freckles.

a) What are the genotypes of the parents?

b) What are the chances that they would have a child, which lacks both freckles & dimples? What is the probability that they would have children with freckles but no dimples?

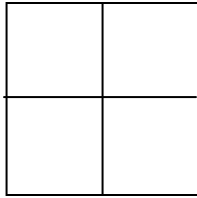


15. In humans, colorblindness is a recessive sex-linked trait.

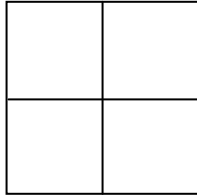
A = normal vision; a = colorblindness

Genotype	Phenotype	Genotype	Phenotype
X ^A X ^A	normal female	X ^A Y	normal male
X ^A X ^a	normal female (carrier)	X ^a Y	colorblind male
X ^a X ^a	colorblind female		

- a) Two normal people have a colorblind son. What are the genotypes of the parents? What genotypes and phenotypes are possible among their children?



- b) A couple has a colorblind daughter. What are the possible genotypes and phenotypes of the parents and the daughter?



16. There are four to six alleles that control fur color in rabbits and many small mammals. The following is the dominance hierarchy for the six alleles: full color (C) is dominant to chinchilla (c^{ch}) > extreme dilution (c^e) > Himalayan (c^h) > platinum (c^p) > albino (c). Show the results from the following crosses:

a. $Cc^p \times c^pc$

b. $C^{ch}c^h \times c^ec^h$

17. A bald man, heterozygous for pattern baldness, marries a woman who is also heterozygous for the trait. What fraction of their:

a. What are the genotypes of the two individuals? **Show your work for the cross below.**

b. Sons will be bald?

c. Daughters will be bald?

18. A woman who appears very fair skinned but has one dominant gene for skin color. She marries a man who is white (totally recessive for skin color). **Explain** if any of their children have dark skin (i.e. darker than their mother's).

E. HUMAN GENETICS

19. Using the following information below, fill out Table 1 for you. Note: some of these traits are dominant, whereas others are incompletely dominant.

PTC: taster (T-), non-taster (tt)

Sodium benzoate: taster (B-), non-taster (bb)

Hair type: Is your hair naturally curly (CC), wavy (Cc), or straight (cc)?

Hair color: Dark hair (DD or Dd) is dominant over light colored hair (dd)

Widow's peak: the presence of a widow's peak is dominant (WW or Ww) over absent (ww)

Eyebrows: bushy (BB or Bb) dominant over fine (bb)

Eye color: non-blue (EE or Ee) is dominant over blue (ee)

Eyelashes: Long (LL or Ll) is dominant over short (ll). Long is greater than 1 cm.

Freckles: present (FF or Ff) is dominant over absent (ff)

Nose profile: Convex nose (NN or Nn) is dominant over straight nose (nn)

Earlobes: free or unattached to sides of the head (UU or Uu) is dominant over attached (uu)

Lip thickness: thick lips (TT or Tt) are dominant over thin lips (tt)

Tongue roller: the ability to roll into U shape (RR or Rr) is dominant over non-rollers (rr)

Mid-digital hair: presence (H-), absence (hh)

Bent little finger: bent (B-), straight (bb)

Hand clasp: Left over right (L-), right over left (ll)

Foot arch: high arch (A), low arch or flat feet (aa)

Hitch-hiker's thumb: $> 50^\circ$ (H-), $< 50^\circ$ (hh)

Palmaris longus muscle tendon: absent (A-), present (aa)

Table 4: Your phenotype and genotype compared with your parents.

TRAIT	YOUR PHENOTYPE	YOUR GENOTYPE	MOTHER'S PHENOTYPE	FATHER'S PHENOTYPE
PTC			-----	-----
SB				
Hair type				
Hair color				
Widow's peak				
Eyebrows				
Eye color				
Eyelashes				
Freckles				
Nose profile				

Ear lobes				
Lip thickness				
Tongue roller				
Mid-digital hair				
Bent little finger				
Hand clasp				
Foot arch				
Hitch-hiker's thumb				
<i>Palmaris longus</i>				

20. Which parent do you have more in common with? Calculate the percent of agreement with **each parent** in order to answer the question (i.e. # of phenotypes that agree with mom/17 x 100).

21. Fill in Table 5 for cohort phenotype comparison.

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TRAIT	YOUR PHENOTYPE	Cohort #1 Phenotype Name: Ethnicity:	Cohort #2 Phenotype Name: Ethnicity:
PTC			
SB			
Hair type			
Hair color			
Widow's peak			
Eyebrows			
Eye color			
Eyelashes			
Freckles			
Nose profile			
Ear lobes			
Lip thickness			
Tongue roller			
Mid-digital hair			
Bent little finger			
Hand clasp			
Foot arch			
Hitch-hiker's thumb			
<i>Palmaris longus</i>			

22. Calculate the percent phenotypic agreement with each cohort.

23. Comment on the phenotypic agreement above (why would you have more, less, same amount of agreement?).