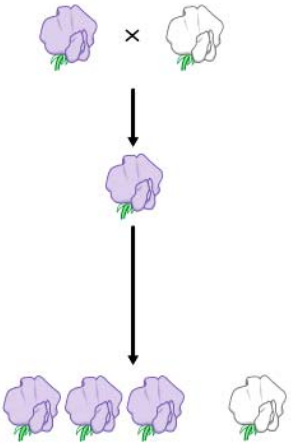
Chapter 9; Mendelian Genetics

Gregor Mendel

•Was the first person to analyze patterns of _____

•Deduced the fundamental principles of _____

•Mendel studied garden _____



Cross fertilization

•Mendel carried out some _____

•Mendel then crossed two different _____ varieties, creating _____

•He also created _____ varieties of plants

•He tracked several characteristics in pea plants from which he formulated several _____

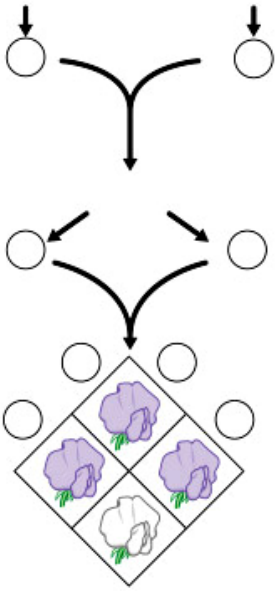
Mendel's hypotheses

•Mendel developed four hypotheses from the _____ cross

•There are alternative forms of genes, now called _____

•For each characteristic, _____

•Gametes carry only _____ for each inherited characteristic



•Alleles can be _____ or _____

•A _____ is the actual alleles inside an organism's DNA

•A _____ is how the organism expresses the _____ within their cells

Monohybrid Crosses

•A _____ cross is a cross between parent plants that differ in only one characteristic

•The characteristic (gene) in this cross is _____

•Which color is dominant?_____

•A _____ is used to determine the possible genotypes and phenotypes of offspring possible during a cross between two organisms

•_____ are the original parents

•_____ means offspring (filial) generation #1

•_____means offspring generation #2 (usually a cross of the F_1 generation as _____)

Principle of segregation

•Pairs of alleles segregate (_____) during gamete formation; the fusion of gametes at _____ creates allele pairs again

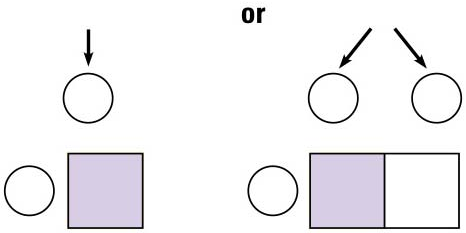
Homozygous and heterozygous

•_____; When an organism has identical alleles for a gene (homo = same)

•Example: bb for _____ eyes or BB for _____ eyes

•_____; When an organism has different alleles for a gene (hetero = different)

•Example: Bb for _____ eyes



•If there is a gene for blue eyes in this person, why are they brown eyed?_____

_____

Using a Testcross to Determine an Unknown Genotype

•A _____ is a mating between an individual of unknown genotype and a _____ recessive individual

•If any of the offspring from this cross are white, what does that tell you about the purple parent flower?_____

<u>The rule of _____</u>;

•The probability of a compound event is the product of the separate probabilities of the _____ events

•That means _____ the probability of one thing happening with the _____ of the other happening at the same _____ (like flipping 2 _____ at the same time).

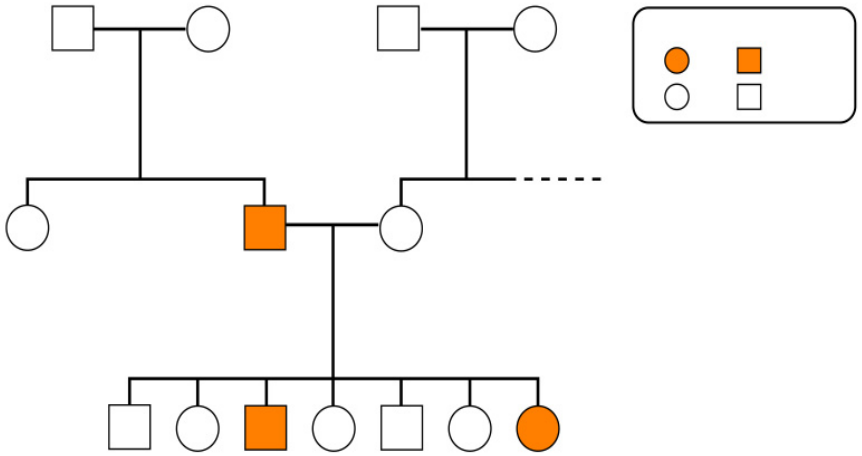
Family Pedigrees

•A family _____

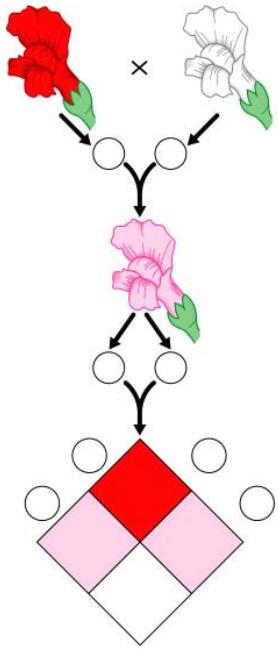
•Shows the history of a trait in a _____

•Allows researchers to analyze _____ traits

•What are the phenotypes of these individuals? (fill them in on chart →)



Recessive Disorders



•Most human genetic disorders are _____

•Individuals can be _____ of these diseases

•How did deafness "pop-up" in this family?_____

_____

Incomplete Dominance in Plants and People

•In _____ F_1 hybrids have an appearance in between the phenotypes of the two parents

•How is this different from normal dominance and recessiveness?_____

_____

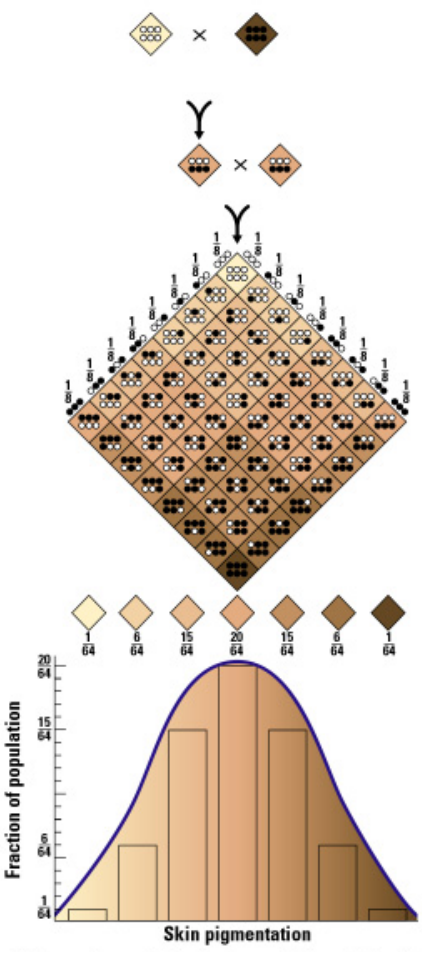
Multiple Alleles and Blood Type

•The ABO blood groups in humans are examples of _____

•Two of the human blood type alleles exhibit _____

•Both alleles are expressed in the _____

Polygenic Inheritance (fill in figure)



•Polygenic inheritance is the additive effects of two or more genes on a single _____

•The more copies of the _____ traits an offspring recieves, the more more "_____" they appear

•Example;_____

Sex-Linked Genes

•Are any genes located on the X

_____

•Were discovered during studies on

_____

Sex-Linked Disorders in Humans

•A number of human conditions result from _____ genes

•Red-green _____ blindness

•Is characterized by a malfunction of light-sensitive cells in the _____

Review Questions:

Be sure to study all of the figures and questions asked in the notes above.

1. What is the difference between dominant and recessive alleles?
2. How are a genotype and phenotype different?
3. A cross between parent plants that differ in only one characteristic is a;
4. What is used to determine the possible genotypes and phenotypes of offspring possible during a cross between two organisms?
5. What does F1 mean?
6. What does P mean?
7. What does F2 mean?
8. When an organism has identical alleles for a gene it is
9. When an organism has different alleles for a gene it is
10. What is a mating between an individual of unknown genotype and a homozygous recessive individual?
11. How do you find the possibility of one thing happening with the probability of the other happening, at the same time?
12. What is a family pedigree?
13. Why are most diseases in humans recessive?
14. When two very different parents have an offspring that is a mix between them, then the trait is;
15. What do you call one pair of alleles that results in three possible different phenotypes?
16. When you mix a pure-breeding dominant phenotype plant with a recessive phenotype plant the offspring are all called
17. The actual alleles inside an organism's DNA are its;
18. How an organism expresses the genotype within their cells is called its
19. A cross between two parent plants that differ in only one characteristic is called a
20. What is used to determine the possible genotypes and phenotypes of offspring possible during a cross between two organisms?
21. In a monohybrid cross (both parents heterozygotes) what is the **phenotypic** ratio of offspring? (do it)
22. In the same cross, what is the **genotypic** ratio of offspring?
23. How are probabilities of an event expressed?
24. A mating between an individual of unknown genotype and a homozygous recessive individual is called a;
25. A picture that shows circles and squares connected is a
26. Most diseases that kill a person before they can have children are;_____Why?

27. Describe the dominance pattern in blood types
28. What is a trait where the additive effects of two or more genes affect a single phenotype?
29. When a gene is carried on the X chromosome that trait is;
30. What are some examples of sex-linked traits?
31. Skin color is an example of what type of trait?
32. What are some traits that show more than one level of dominance and recessiveness (a sequence)?
33. Eyebrow thickness is an example of what type of trait?
34. What is the recipe for solving a genetics problem?
    a. *First;* _____
    b. *Second;* _____
    c. *Third;* _____
    d. *Fourth;* _____

Genetics problems on quiz;

Be able to do the following types of crosses;

Basic dominant and recessive (monohybrid)

Incomplete dominance (codominant)

(remember 3 phenotypes for one gene = codominant)

Blood types

Sex linked

Polygenic inheritance (determine the gametes, only)

Given the offspring, be able to make statements about the parents (reverse detective work)

Genetics Practice Problems (there may be repeats here from above)

Normal dominance and recessiveness

35. What do you write for the genotype of a person who shows the dominant phenotype, but with no other information?
36. What is the recipe for doing a genetics problem?
37. What is the genotype of a person who is showing the recessive phenotype?
38. How can you use children to solve questions about the genotypes of the parents?
39. In humans, free earlobes are dominant to attached ears. A person who is heterozygous for free earlobes marries a person with attached earlobes. What is the ratio of free vs. attached earlobes in the children?

Now for some reverse detective work…

40. Two people who have free earlobes have four children, one of which has attached ears. What are the genotypes of the parents?
41. In peas, green is dominant to yellow for seed color. A homozygous green plant is crossed with a yellow plant. What is the ratio of green versus yellow offspring?
42. Using another green plant and another yellow plant as parents, half of the offspring are yellow and half are green. What does that tell you about the green parent?
43. In humans, brown eye color is dominant to blue. Two brown eyed people get married, and have children. Most of the kids have brown eyes, but one of the children has blue eyes. The father sues for divorce. Is he correct to assume that his wife cheated on him with another man? Why?
44. What if both of the parents had blue eyes and one of the children was born with dark brown eyes?

Blood typing

45. What are the possible genotypes for blood types; A, AB, B, O
46. Which of these alleles is dominant? Which are recessive?
47. What is the term for two equally dominant genes?
48. A person with type AB marries a person with type O. What are the ratios of offspring that would result from their marriage?
49. Two type A people get married and have children. Most of the children have type A blood. One of the children has type B blood. The father sues for divorce. Is he justified? Explain.
50. What if none of the children was B but one of the children was type O. What would you tell him?
51. What if two type O people have a type A baby? What would you tell the father?

Incomplete dominance

52. How can you tell a trait is incompletely dominant?
53. What is a trait in humans that is incompletely dominant (or codominant)?
54. What is a trait in flowers that is codominant?
55. If a white flower were crossed with a red flower, what will all of the offspring look like?
56. If you cross two pink flowers together, what is the phenotypic ratio of offspring?
57. What is the genotypic ratio of offspring?
58. Why is that true?
59. Is that the same for regular dominant and recessive genes?

Sex-linked genes

60. How do you write the genotype for a woman in a sex-linked genetics problem?

61. Do you write it that way for ALL genetics problems? Why?

62. Why do you never write an allele symbol on the Y chromosome for sex-linked genes?

63. Where do all boys receive their sex-linked genes?

64. Can a father ever give a sex-linked gene to his daughter? Son?

65. Why do males show sex-linked recessive genes in their phenotypes twice as often as women do?

Now for some problems. Remember to use X*X* and X*Y for all genotypes (* = specific allele)

66. In humans, hemophilia is a sex-linked recessive gene (don't forget the recipe). A male hemophiliac marries a carrier female and has children. What is the probability of them having a;

- hemophiliac boy,
- hemophiliac girl,
- carrier girl,
- carrier boy,
- and normal boy and normal girls? (Ignore the 50% sex issue, the question is given that sex, what are the chances of the genotype occurring?)

Sex-linked genes

67. A normal man and a colorblind woman have children. One of their sons has normal vision. What would you tell the father? Should he sue for divorce?

68. A normal man and a normal woman have many children. One of them is color blind (a boy). Should the father be upset? Why?

69. Some unknown genotypes can be filled in by looking two directions in a pedigree. What are they?