

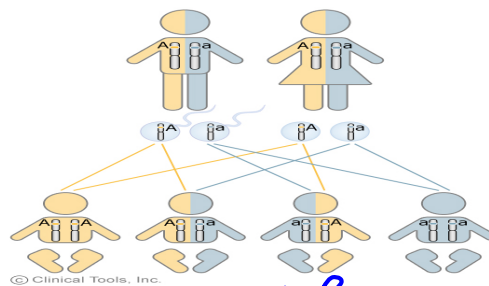
Heredity

Meet the Super Cow [www.keepvid.co]

Study of genes and traits and how they are passed on.

Law of Segregation

Alleles pairs separate during the formation of gametes and each allele has an equal chance of being passed on.



Ex:

BB 100% B Bb 50% B 50% b bb 100% b

Dominance and recessive

	Trait					
	stem length	seed shape	seed colour	seed coat colour	pod shape	pod colour
Dominant	tall	round	yellow	coloured	inflated	green
Recessive	short	wrinkled	green	white	constricted	yellow

Write all the possible alleles for each example below using the table above

a) tall stems?

TT or Tt

b) short stems?

tt

c) inflated pods?

II or Ii

d) constricted pods?

ii








e) green pods?

Gg or GG

f) yellow pods?

gg

Human Inheritance

Traits	Dominant trait	Possible genotypes	Your phenotype	Looks like
Widow's peak	Peak	PP Pp	= widow no peak	
Tongue rolling	Ability	RR Rr rr		
Hitchhiker's thumb	Straight			
Free earlobe	Free			
Hair middle joint finger	Hair			
Toe length	Long 2nd toe			
PTC testing	Can taste			

Determining possible offspring

Ex 1- In pea plants, tall plants are dominant over short plants. A heterozygous plant is crossed with a short plant. Draw the punnett square that would result and give the genotype and phenotype ratios.

Parent 1 $T+$ Parent 2 $++$

	T	$+$
$+$	$T+$	$++$
$+$	$T+$	$++$

G

$T+$ $++$
 $1:1$

P

Tall short
 $1:1$

Ex 2- In pea plants, yellow seeds are dominant over green seeds. A homozygous yellow seed is crossed with a heterozygous yellow seed. Draw the punnett square that would result and give the genotype and phenotype ratios.

Parent 1 Y/Y x Y/y

	Y	Y
Y	Y/Y	Y/y
y	Y/y	y/y

G

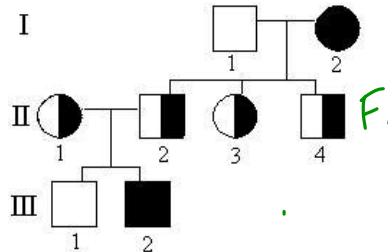
Y/Y Y/y
 $1:1$

P

yellow
 $1:0$

Generations

F ₁	Offspring of original mother and father
F ₂	Offspring of F ₁
F ₃	Offspring of F ₂



Word problems

1. Albinism is a recessive disease where the person has no pigmentation. If a heterozygous female reproduces with a homozygous dominant male, what are the phenotype and genotype % and ratios?

$$\begin{array}{c}
 a \quad a \\
 \hline
 Aa \times Aa \\
 \hline
 Aa \quad Aa \\
 aa \quad aa
 \end{array}
 \quad
 \begin{array}{c}
 P \\
 \hline
 G \\
 \hline
 aa \quad aa \\
 1 : 1
 \end{array}
 \quad
 \begin{array}{c}
 P \\
 \hline
 No \text{ albinism} \\
 1 : 0
 \end{array}$$

2. Huntington's is a dominant disease where a person's nervous system starts to degenerate. A heterozygous male mates with a normal female.

- a- What are the chances of their offspring having the disease?

$$\begin{array}{c}
 Hh \times hh \\
 \hline
 Hh \quad hh \\
 Hh \quad hh
 \end{array}
 \quad
 \begin{array}{c}
 \text{30\% chance} \\
 F_1
 \end{array}$$

- b- Explain if it is possible for the F₂ generation to have it.

Yes because the F₁ generation carries the "H" allele.

- i. Two brown eyed parents had three children with brown eyes and one child with blue eyes. If brown eyes are dominant over blue eyes, determine the genotype of the parents.

$$\begin{array}{c}
 B \quad b \\
 \hline
 BB \quad Bb \\
 Bb \quad bb
 \end{array}
 \quad
 \begin{array}{c}
 BB \quad Bb \\
 \hline
 BB \quad Bb \\
 Bb \quad Bb
 \end{array}$$

Explain if the brown eyed children of the F₁ generation can have kids who are blue eyed? What would this generation be called?

Sex-linked traits

def: Traits carried on the sex chromosome.

- The 'x' or 'y' chromosome.
- Outcomes must be given by sex of child

$XX = \text{female}$
 $XY = \text{male}$

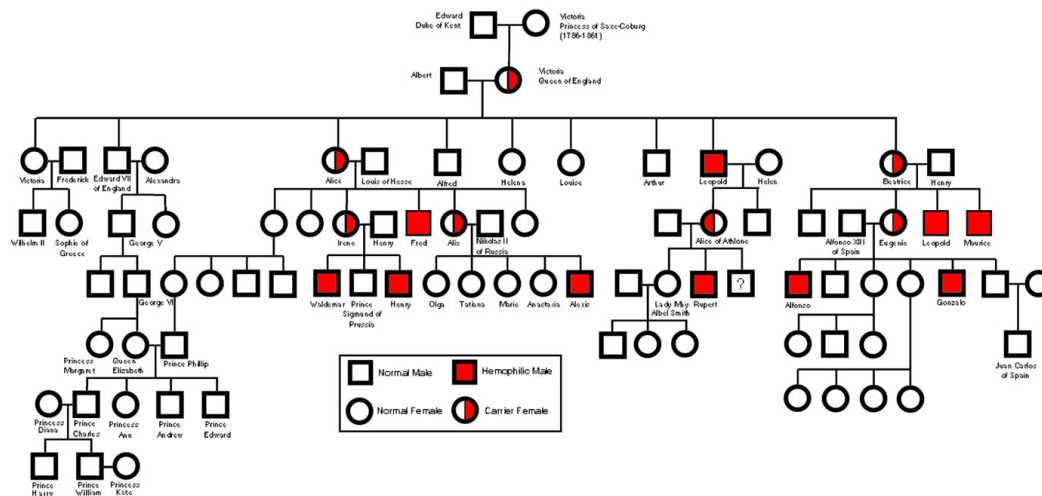
Possibilities

XX	$X^C X$	$X^C X^C$	xy	$x^c y$	xy^c
normal female	normal female carrier	female has it	normal male	male has it	male has it

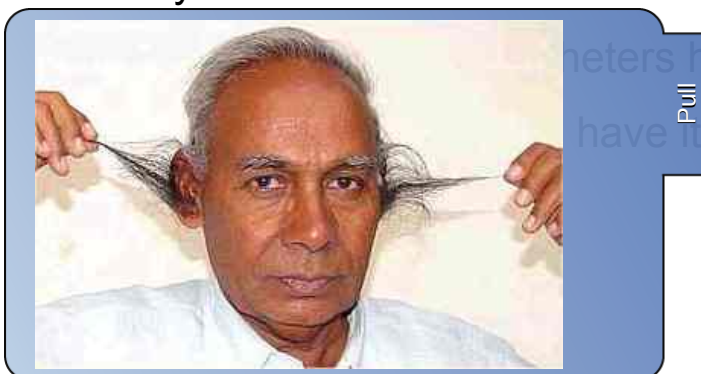
- colour blindness, hemophilia and baldness are all carried on 'x' chromosome
- hairy ears on 'y' chromosome.

Hemophilia

- Queen Victoria a carrier - pedigree shown below.



Hairy ears



have it

Ex 1- A colour blind male mates with a female who is a carrier. What are the chances of the offspring being colourblind?

$$X^c y \times X^c X$$

	X^c	X
X^c	$X^c X^c$	$X^c X$
y	$X^c y$	Xy

$\text{♀} = 50\%$
 $\text{♂} = 50\%$

Ex 2- A bald female and a non-bald male mate. What are the chances the child will be bald as an adult?

$$X^c X^c \times X X$$

	X^c	X^c
X	$X^c X$	$X^c X$
y	$X^c y$	$X^c y$

$\text{♀} = 0\%$
 $\text{♂} = 100\%$

Ex3- A couple had two girls and a boy. One girl is colourblind and the other two are not. What were the genotypes of the parents?

$$X^c y \times X^c X$$

	X^c	y
X^c	$X^c X^c$	$X^c y$
X	$X^c X$	Xy

Ex4- Three brothers feel very depressed because they are doomed to have hairy ears like their dad. They are jealous because their three sisters will not have this problem. Explain why all the boys are doomed and none of the girls are.

Carried on "y" chromosome
 & girls do not have a
 y.

Crossing 2 traits at once - Use foil

Ex 1- Curly hair is dominant over straight hair and brown eyes are dominant over blue eyes. CB

Give the percentage of the phenotype and genotype of the offspring when a homozygous curly haired blue eyed female mates with a heterozygous male for both hair and eyes.

Parent 1: $CCbb$

Possible gametes:

Cb Cb Cb
 Cb

Parent 2: $CcBb$

Possible gametes

CB Cb cB cb

	Cb	Cb	Cb	Cb
CB	$CCBb$	$CCBb$	$CCBb$	$CCBb$
Cb	$CCbb$	$CCbb$	$CCbb$	$CCbb$
cB	$CcBb$	$CcBb$	$CcBb$	$CcBb$
cb	$Ccbb$	$Ccbb$	$Ccbb$	$Ccbb$

G
 $CC Bb$ 25%
 $CC bb$ 25%
 $Cc Bb$ 25%
 $Cc bb$ 25%

P
 Curly + brown eyes
 50%
 curly + blue
 50%

Ex 2- Being able to tongue roll is dominant over not tongue rolling.
Free earlobes are dominant over attached earlobes.

$R F$

What will the genotype and phenotype be for the F_1 generation when a heterozygous tongue roller with attached ears mates with a homozygous recessive tongue rolling and heterozygous for earlobes.

Parent 1:

$Rrff$

Parent 2:

$rrFf$

Possible gametes: Rf rf

Possible gametes: rF rf

	Rf	Rf	rf	rf
rF	$RrFf$	$RrFf$	$rrFf$	$rrFf$
rF	$RrFf$	$RrFf$	$rrFf$	$rrFf$
rf	$Rrff$	$Rrff$	$rrff$	$rrff$
rf	$Rrff$	$Rrff$	$rrff$	$rrff$

G
 $RrFf = 25\%$
 $Rrff = 25\%$
 $rrFf = 25\%$
 $rrff = 25\%$

P
 Tongue roller + free
 25%
 25% T + A
 25% No T + F
 25% No T + A

Is it possible for the F_2 generation to be homozygous dominant or homozygous recessive for both traits?

yes- $RrFf$ $rrff$

Past Exam Questions

1. Cedric has decided to breed his pet mice. He knows that black fur colour is dominant to white fur colour in mice. Black mice get a higher price at the pet store. He crosses a black mouse with a white mouse. He expected all the offspring produced to have black fur. However, he was disappointed to discover 4 white and 4 black mice in the litter. What mistake did Cedric make?

A) He assumed black alleles were more common than white.
B) He assumed the white alleles were more common than black.
C) He assumed his black mouse was homozygous for black fur. *BB bb*
D) He assumed his black mouse was homozygous for white fur.

2. Scientists often breed Guinea pigs to study genetic characteristics. In one experiment, they crossed a homozygous dominant black haired male with a homozygous recessive white haired female. They observed that all of the offspring were heterozygous black haired.

Characteristic of Guinea Pigs

Trait / Characteristic	Dominant Allele	Recessive Allele
Colour of hair	Black (B)	White (b)



The scientists then do a second cross between a homozygous dominant black haired male and a heterozygous black haired female. *BB x Bb*

a) State the genotype for both individuals in the second cross and draw the Punnett square that shows the offspring produced from this cross.

b) Give the phenotypic ratio of the offspring produced from the cross in question a).

Attachments



Mendel Single Trait Experiments _ Genetics _ Biology.mp4



Meet the Super Cow [www.keepvid.com].mp4