

GENETIC PROBLEMS

Question #1

- How many different kinds of **gametes** could the following individuals produce?
 1. aaBb
 2. CCDdee
 3. AABbCcDD
 4. MmNnOoPpQq
 5. UUVVWWXXYYZz

Question #1

- Remember the formula 2^n
- Where $n = \#$ of heterozygous

1. aaBb = 2

2. CCDdee = 2

3. AABbCcDD = 4

4. MmNnOoPpQq = 32

5. UUVVWWXXYYZz = 2

Question #2

- In dogs, wire-haired is due to a dominant gene (W), smooth-haired is due to its recessive allele (w).
- WW, Ww = wire haired
- ww = smooth haired

Question #2A

- If a homozygous wire-haired dog is mated with a smooth-haired dog, what type of offspring could be produced.



Question #2A

	W	W	
w	Ww	Ww	} F₁ generation all heterozygous
w	Ww	Ww	

Question #2B

- What type(s) of offspring could be produced in the F_2 generation?
- Must breed the F_1 generation to get the F_2 .
- $Ww \times Ww$

Question #2B

	W	w	
W	WW	Ww	} F ₂ generation
w	Ww	ww	

genotype: 1:2:1 ratio

phenotype: 3:1 ratio

Question #2C

- Two wire-haired dogs are mated. Among the offspring of their first litter is a smooth-haired pup.
- If these, two wire-haired dogs mate again, what are the chances that they will produce another smooth-haired pup?
- What are the chances that the pup will wire-haired?

Question #2C

	W	w
W	WW	Ww
w	Ww	ww

F₂ generation

- 1/4 or 25% chance for smooth-haired
- 3/4 or 75% chance for wire-haired

Question #2D

- A wire-haired male is mated with a smooth-haired female. The mother of the wire-haired male was smooth-haired.
- What are the phenotypes and genotypes of the pups they could produce?
- Breed: $Ww \times ww$

Question #2D

	W	w
w	Ww	ww
w	Ww	ww

phenotypes: 2:2 ratio

genotypes: 2:2 ratio

Question #3

- In snapdragons, **red flower (R) color is incompletely dominant over white flower (r) color.**
- **The heterozygous (Rr) plants have pink flowers.**

RR - red flowers

Rr - pink flowers

rr - white flowers

Question #3A

- If a red-flowered plant is crossed with a white-flowered plant, what are the genotypes and phenotypes of the plants F_1 generation?
- $RR \times rr$

Question #3A

	R	R
r	Rr	Rr
r	Rr	Rr

F₁ generation

phenotypes:

100% **pink**

genotypes:

100% **heterozygous**

Question #3B

- What genotypes and phenotypes will be produced in the F_2 generation?
- $Rr \times Rr$

Question #3B

	R	r
R	RR	Rr
r	Rr	rr

F₂ generation

phenotypes: 1:2:1 ratio

genotypes: 1:2:1 ratio

Question #3C

- What kinds of offspring can be produced if a red-flowered plant is crossed with a pink-flowered plant?
- $RR \times Rr$

Question #3C

	R	R
R	RR	RR
r	Rr	Rr

50%: red flowered

50%: pink flowered

Question #3D

- What kind of offspring is/are produced if a pink-flowered plant is crossed with a white-flowered plant?
- $Rr \times rr$

Question #3D

	R	r
r	Rr	rr
r	Rr	rr

50%: white flowered

50%: pink flowered

Question #4

- In humans, colorblindness (cc) is a recessive sex-linked trait.
- Remember: XX - female
XY - male

Question #4A

- Two normal people have a colorblind son.
- What are the genotypes of the parents?
- $X^C X_{-?}$ x $X^C Y$
- What are the genotypes and phenotypes possible among their other children?

Question #4A

X^C Y ← parents

X^C	$X^C X^C$	$X^C Y$
X^c	$X^C X^c$	$X^c Y$

50%: female (one normal, one a carrier)

50%: male (one normal, one colorblind)

Question #4B

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

Question #4B

	X^c	Y
X^C	$X^C X^c$	$X^C Y$
X^c	$X^c X^c$	$X^c Y$

parents: $X^c Y$ and $X^C X^c$ or $X^c X^c$

father colorblind

mother carrier or colorblind

daughter: $X^c X^c$ - colorblind

Question #5

- 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).

Question #5A

- Two persons with freckles and dimpled cheeks have two children: one has freckles but no dimples and one has dimples but no freckles.
- What are the genotypes of the parents?

Parents: F_ D_ x F_ D_

Children: F_ dd x ffD_



Question #5B

- What are the possible phenotypes and genotypes of the children that they could produce?
- Breed: $FfDd \times FfDd$
- This is a dihybrid cross

Question #5B

- Possible gametes for both: FD Fd fD fd

	FD	Fd	fD	fd
FD	FFDD	FFDd	FfDD	FfDd
Fd	FFDd	FFdd	FfDd	Ffdd
fD	FfDD	FfDd	ffDD	ffDd
fd	FfDd	Ffdd	ffDd	ffdd

Question #5B

Phenotype:	Freckles/Dimples:	9
	Freckles/no dimples:	3
	no freckles/Dimples:	3
	no freckles/no dimples:	1

Phenotypic ratio will always been 9:3:3:1
for all dihybrid crosses.

Question #5B

Genotypic ratio:	FFDD	- 1
	FFDd	- 2
	FFdd	- 1
	FfDD	- 2
	FfDd	- 4
	Ffdd	- 2
	ffDD	- 1
	ffDd	- 2
	ffdd	- 1

Question #5C

- What are the chances that they would have a child whom lacks both freckles and dimples?
- This child will have a genotype of **ffdd**
- **Answer:** 1/16

Question #5D

- A person with freckles and dimples whose mother lacked both freckles and dimples marries a person with freckles but not dimples whose father did not have freckles or dimples.
- Breed: $FfDd \times Ffdd$
- Possible gametes: $FD \ Fd \ fD \ fd \times Fd \ fd$

Question #5D

- What are the chances that they would have a child whom lacks both freckles and dimples?

	FD	Fd	fD	fd
Fd	FFDd	FFdd	FfDd	Ffdd
fd	FfDd	Ffdd	ffDd	ffdd

Answer: 1/8

Question #6

- Henry Anonymous, a film star, was involved in a paternity case. The woman bringing suit had two children, on whose blood type was A and the other whose blood type was B.
- Her blood type was O, the same as Henry's!
- The judge in the case awarded damages to the woman damages to the woman, saying that Henry had to be the father of at least one of the children.

Question #8A

- Obviously, the judge should be sentenced to **Biology**. For Henry to have been the father of both children, his **blood type** would have had to be what?

	I ^A	I ^B	← Answer
i	I ^A i	I ^B i	
i	I ^A i	I ^B i	