Genetic Problems I

Solutions

#1 B = Buck
b = White

a.) BB x bb = 1:0 All Buck , 1:0 All Bb

b.) Bb x bb 1:1 50% Buck 50% White , 1:1 50% Bb 50% bb

c.) Bb x BB 1:0 All Buck , 1:1 50% Bb 50% BB

#2

a.) 3 Buck B_ 1 White bb → Parents Bb x Bb ← Little Confidence

b.) 3 Buck B_ → BB x BB Low Confidence

c.) 19 White bb → bb x bb High Confidence

#3 IF B = BLACK
b = WHITE

a) BLACK GUINEA PIG. → TEST CROSS
B ?

BLACK WHITE
B ? × bb

IF BB THEN ALL OFFSPRING BLA
BUT IF Bb THEN 50% BLACK
50% WHITE

c) GETTING A WHITE PIG.
(EVEN ONE)

b.) TEST CROSS

#4 B = BLACK
b = WHITE

BLACK × WHITE

a) IF 23 OFFSPRING BLACK THEN BLACK BB

b) IF 12 OFFSPRING BLACK AND ONE IS WHITE THEN
BLACK WAS
Bb.

#5 B = Black
b = white

Bb × Bb ⟶

	B	b
B	BB	Bb
b	Bb	bb

a) Prob of 1 Black is 3/4.
So Prob of 3 uses Rule of Mult Inside $(3/4)(3/4)(3/4) = 27/64$

b) Prob of B, B, w, w
$(3/4)(3/4)(1/4)(1/4) = 9/256$

c) Prob 3 Black Mice
$(3/4)(1/2)(3/4)(1/2)(3/4)(1/2) = 27/512$

d) A Black & A white &

Scenario #1 $(3/4)(1/2)(1/4)(1/2) = 3/64$
BF wm

Scenario $(1/4)(1/2)(3/4)(1/2) = 3/64$
wm BF

$+$

$6/64$

Rule of Addition

#6 B = Black, b = White Bb x Bb Prob. of Black is 3/4, Prob of White is 1/4

a) BBBw → (3/4)(3/4)(3/4)(1/4) = 27/256
BBwB → (3/4)(3/4)(1/4)(3/4) = 27/256
BwBB → = 27/256
wBBB → = 27/256
+

108/256 = 27/64

b) BBWW → (3/4)(3/4)(1/4)(1/4) = 9/256
BWWB 9/256
WBBW 9/256
WWBB 9/256
WBWB 9/256
BWBW. 9/256
+

54/256 = 27/128

c. MMMF → (1/2)(1/2)(1/2)(1/2) = 1/16
MMFM 1/16
MFMM 1/16
FMMM 1/16
+

4/16 = 1/4

#7 Red x White → 1:2:1

* Note: A Complete Dominance Situation would lead to a 3:1 phenotypic ratio!

↳ Gene interactions either Co-Dominance OR Incomplete Dominance

b.) IF Pink shows up then Incomplete Dominance

c.) IF Red & White Mixed shows up then Co-Dominance

#8

a.) $C^RC^R \times C^WC^W$ = Pheno 1:0 All Pink, Geno 1:0 All C^RC^W

b.) $C^RC^W \times C^WC^W$ — 1:1 (50% Pink, 50% White); 1:1 (50% C^RC^W, 50% C^WC^W)

c.) $C^RC^W \times C^RC^R$ — 1:1 (50% Pink, 50% Red); 1:1 (50% C^RC^W, 50% C^RC^R)

#9

a.) Bull x Cow

&

2 C^RC^W, 6 C^RC^R, 1 C^WC^W

Both Parents Are C^RC^W x C^RC^W Very Confident.
(Roan) (Roan)

b.) Bull x Cow

2 C^RC^R

Neither Parent Can Be White Very Confident
But Parents Could Be Roan or Red And Rarely
Any Combo of The Two

c.) Bull x Cow

17 C^WC^W

Both Parents Are White (C^WC^W) Very Confident

#10 N in this case indicates the Hybrid Genotype Results in Phenotypic Difference from the Homozygous Dominant Genotype

#11 Bull x Cow
Offspring x Offspring

a) Red, white, Roan → (1/4)(1/4)(1/2) = 1/32
Red Roan white → (1/4)(1/4)(1/2) = 1/32
Roan, Red, white = 1/32
Roan, white, Red = 1/32
white, Red, Roan = 1/32
white, Roan, Red = 1/32

6/32 = 3/16

b.) Red, white, Roan
(1/4) (1/4) (1/2) = 1/32

#12 Amputated = aa (lethal) — only!
Normal = AA
Aa (carrier)

a.) Bull x Cow
Aa Aa =

	A	a
A	AA	Aa
a	Aa	~~aa~~

Pheno 3:0 Normal
Geno 2:1 Aa : AA

b.) Bull x Cow
Aa x AA =

	A	a
A	AA	Aa
A	AA	Aa

Pheno 4:0 Normal
Geno 1:1 AA : Aa

#13
Bull x Cow
(Aa) (Aa) →

	A	a
A	AA	Aa
a	Aa	x

a)
Non Carrier, Female And Carrier, Male
$(1/3)$ $(1/2)$ $(2/3)$ $(1/2)$ $= 2/36 = 1/18$

b.)
C C N → $(2/3)(2/3)(1/3) = 4/27$
C N C $= 4/27$
N C C $= 4/27$
$+ \quad 4/27$
$12/27$

#14

a) Woman x Man = (O) (AB)

	i	i
I^A	$I^A i$	$I^A i$
I^B	$I^B i$	$I^B i$

Pheno: 1:1 → A : B

Geno: 1:1 → $I^A i : I^B i$

b) Woman x Man = (AB) (AB)

	I^A	I^B
I^A	$I^A I^A$	AB
I^B	AB	BB

Pheno: 1:2:1 → A : AB : B

Geno: 1:2:1 → $I^A I^A : I^A I^B : I^B I^B$

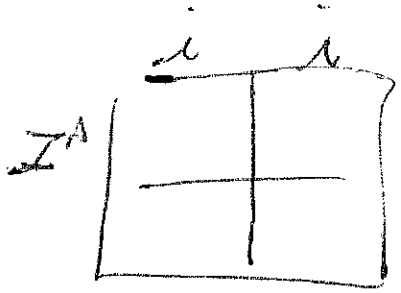
#15

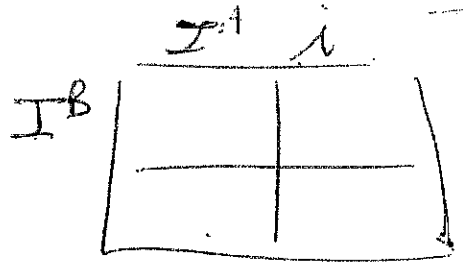
Women x Men

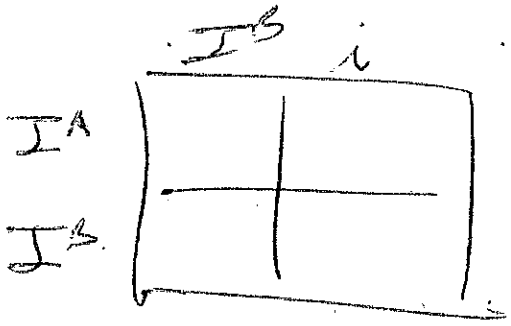
a) O x A

b) A x B

c) B x AB





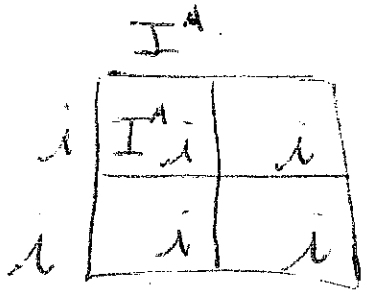


	Possible	Impossible
a)	A	AB
	O	B
b)	AB	None
c)	A	O
	B	
	AB	

#16

a) MOM (?) x HUSBAND (O)
ii

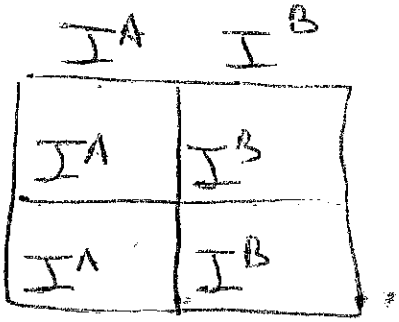
DAUGHTER
(A) $I^A i$
OR
$I^A I^A$



MOM CAN BE I^A_ (A)
OR $I^A I^B$ (AB)

b.) MOM (?) x HUSBAND (AB)

SON
(A) I^A_

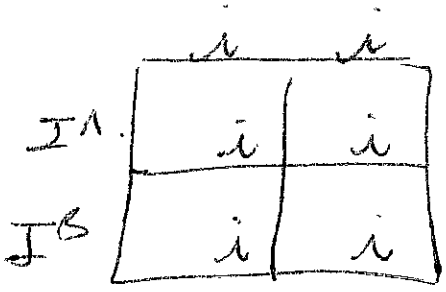


MOM COULD BE ANYTHING (ANY BLOOD TYPE). BUT COULD NOT BE HOMOZYGOUS B

C.) MOM (?) x HUSBAND (O)
ii

DAUGHTER (B)
I^B_

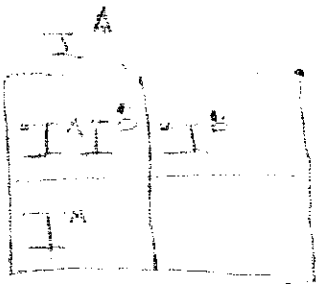
SON (A)
I^A



MOM IS DEFINETLY
$I^A I^B$ (AB)

#17 Woman (M) x Man (S)

$I^M I^M$ x $I^B I^B$



a) Daughter C

$(1/2)(1/4) = 1/8$ *

* Assuming of course both parents are heterozygous. In fact we will assume parents are carriers for the remaining recessive as well for simplicity's sake.

b.) Kid A, Kid A

$(1/4)(1/4) = 1/16$ *

c.) Son A, Daughter A

$(1/2)(1/4)(1/2)(1/4) = 1/64$ *

d) Son A, Daughter A = $1/64$

Daughter A, Son A $+ 1/64$

$2/64 = 1/32$

#11) A^YA^Y = [illegible] (early)
$A^Y\_$ = yellow
AA = Agouti
Aa = Agouti
aa = Black

$A^Y > A > a$

7) $A^YA \times A^Ya$

	A^Y	A
A^Y	~~A^YA^Y~~	A^YA
a	A^Ya	Aa

Pheno: 2 : 1 Yellow : Agouti

Geno: 1 : 1 : 1 A^YA : A^Ya : Aa

) Agouti x Agouti
$AA \times Aa$
$Aa \times AA$
$AA \times AA$
→ Pheno: 1 : 0 All Agouti
Geno: Either 1 : 1 or 1 : 0

But
Aa Aa → 3 : 1 Agouti : Black
1 : 2 : 1 AA : Aa : aa

7) Agouti x Black
$AA \times aa$
1 : 0 All Agouti
1 : 0 All Aa

or
$Aa \times aa$
1 : 1
Agouti : Black
Aa : Aa

#19

A^yA^y = LETHAL (EMBRYO)
$A^y\_$ = YELLOW
AA = AGOUTI
Aa = AGOUTI
aa = BLACK

$A^y > A > a$

a) AGOUTI FEMALE × YELLOW MALE
$A\_ \times A^y\_$
0% CHANCE NO WAY TO PRODUCE A^yA^y OFFSPRING.

b.) FEMALE YELLOW × MALE BLACK
$A^yA \times aa$
0% DITTO

c.) YELLOW FEMALE × BLACK MALE
$A^y\_ \times aa$
0% CHANCE IF FEMALE IS A^ya (CARRYING a allele) BUT IF SHE CARRIES THE A ALLELE THEN.

50% CHANCE

	A^y	A
a		Aa
a		Aa

#20

$C\_$ = Full Color

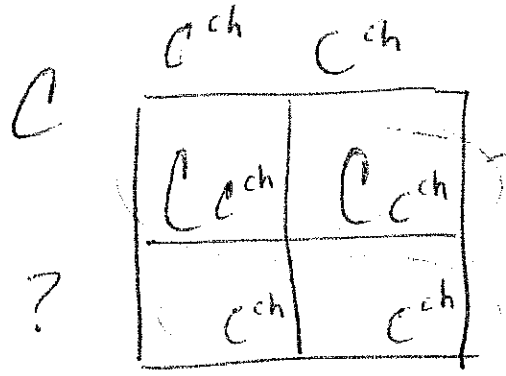
Cc^{ch} = Gray

$c^{ch}c^{ch}$ = Chinchilla

Full Female Unknown Genotype

$C\ ?$ x Mate with Male Chinchilla

So



50% will be Full

But if the other 50% is Chinchilla then female is Cc^{ch}

OR

If 50% is Gray then she is Cc

OR

If all offspring are full then she must be a purebred CC