

GENES, CHROMOSOMES AND PROBABILITY

22 Jan 1996, rvsd 1/27/97, 24 Jan 05, 26Jan09, 25Jan10, 23Jan12, 17Nov2014
 Campbell's 6th: 253-, 7th: 256-264, Sadava 8th: 214-217, Campbell 9th: 264-272, 10th: 272-280
 purple times white gave F1 all purple
 F2 3/4 P, 1/4 white

Mendel proposed that it was because of two laws:

MENDEL'S FIRST LAW of Equal Segregation: (p 269) These were monohybrid crosses,
a trait is due to a pair of hereditary units (genes) which segregate with equal prob during gametogenesis

MENDEL'S SECOND LAW of independent assortment: (p 273)
segregation of one gene pair is independent of a second pair.

page 274:

Dihybrid crosses: RRyy x rrYY:

(R = round, r = wrinkled; Y = yellow, y = green)

crossed yellow round (YR) versus green wrinkled (yr):

F1: 100% yellow round

F2: 315 RY prob R = 3/4 prob Y = 3/4 prod = 9/16

108 Ry prob R = 3/4 prob y = 1/4 prod = 3/16

101 rY prob r = 1/4 prob Y = 3/4 prod = 3/16

32 ry prob r = 1/4 prob y = 1/4 prod = 1/16

315 + 108 = 423 R

101 + 32 = 133 r

3:1

315 + 101 = 416 Y.

108 + 32 = 140 y,

also 3:1

Therefore 9:3:3:1 ratio

Examples of 9:3:3:1 in F2.

corn genetics PpSs (Purple/yellow and Starchy/sweet)

Parakeets:

(blue& yellow genes): Bb/Yy x Bb/Yy:

9 green, 3 blue, 3 yellow, 1 white

color in Labrador Retrievers: gold (C) -> chocolate (B) -> black (p 279)

BbCc selfed: 9 black (B-C-), 3 chocolate (bb,C-) and 4 gold (-,cc)

What is probability of any given phenotype?

Mendel was successful in part because he could fit inexact numbers to ratios following the rules of probability

Random (stochastic) events cause variation in the outcome of the H or T of a flip.

probability of an event = # favorable cases/# total cases

six sided di, rolling a 1 has probability of 1/6,

7 clubs out of a deck = 1/52

any spade = 13/52

event with certainty has probability of 1/1 = 1

probability of an event A + probability of a non-A event = 1

PRODUCT RULE (THE AND RULE) (see p 275 for a discussion)

Probability of the occurrence of two or more **independent events** is the **product** of their probabilities:

What is the chance of rolling a one **and** then a six? [= 1/6 x 1/6 = 1/36]

What is the chance of rain both today (50%) and tomorrow (20%)? [= 0.5 x 0.2 = 0.1 = 0.05]

What is prob of getting aabbcc from AaBbCc times self? [= (1/4 x 1/4 x 1/4)²]

SUM RULE (THE EITHER/OR RULE)

Probability of any one of several **mutually exclusive events** occurring is equal to the **sum** of their individual probabilities:

What is the chance of rolling a 1 **or** a 6 with a di? [= 1/6 + 1/6 = 2/6]

What is chance of drawing *any* face card? [= 1/13 + 1/13 + 1/13 = 3/13]

harder: The chance of rain is 40% today, 20% tomorrow. What is chance no rain either day? [= (1-0.4) x (1-0.2) = 0.48]

What is the probability a brown eyed man who has 4 brown eyed children with a blue eyed woman is heterozygous?

What is the probability that he is homozygous?

Answer: Assume he is heterozygous, calculate probability of each child being brown eyed, multiply all, subtract from 1.

