

Introduction to genetics and patterns of inheritance: Mendelian genetics - انسباير part 2



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ملفات اكتب للمعلم اكتب للطالب | اختبارات الكترونية | اختبارات | حلول | عروض بوربوينت | أوراق عمل
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المزيد من مادة
علوم:

إعداد: Adel Rania

التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة علوم في الفصل الأول

مراجعة الأنماط الأساسية للوراثة البشرية - بريدج

1

Introduction to genetics and patterns of inheritance: Mendelian genetics - part 2 انسباير

2

الوراثة المعقدة والوراثة البشرية كامبردج

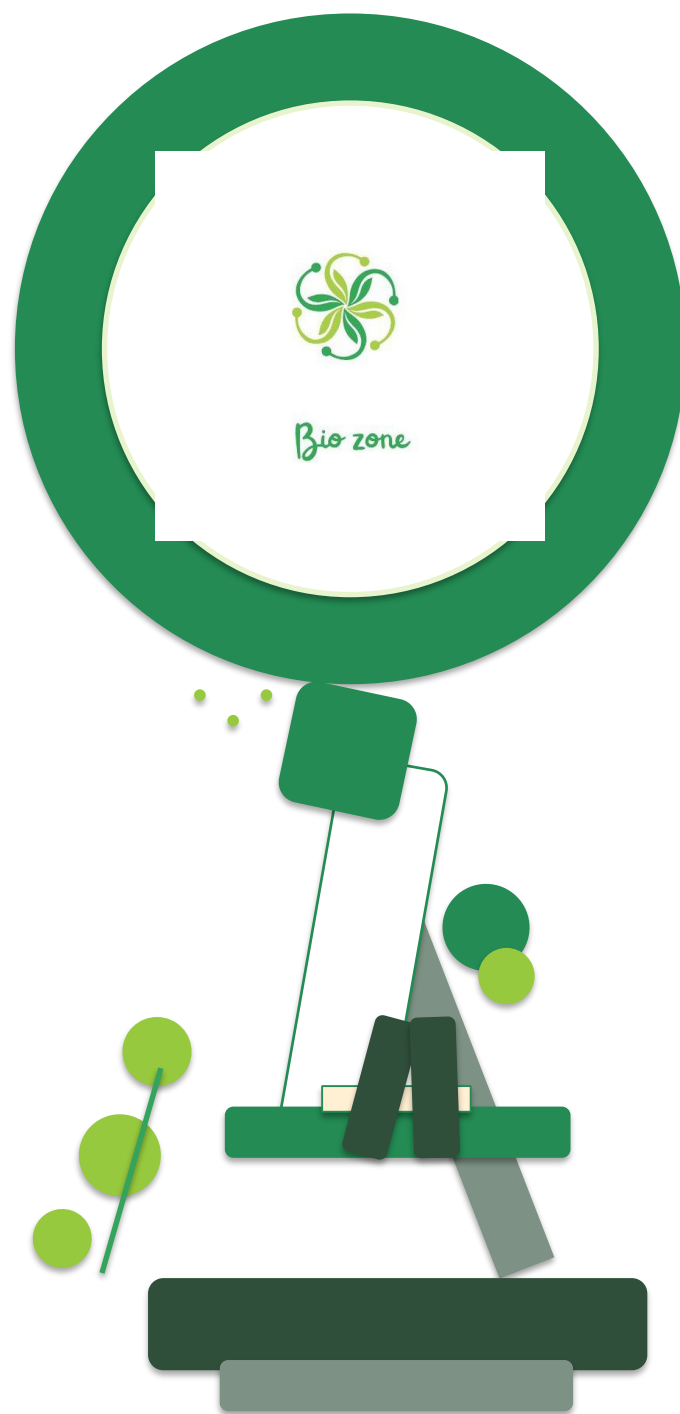
3

Introduction to genetics and patterns of inheritance انسباير inspire

4

نموذج اختبار تجريبي Exam Mock منهج انسباير

5



BIO

Introduction to genetics and patterns of inheritance

Mendelian genetics



DATE

04 / 09 / 2026



TEACHER

Rania
Adel



GRADE

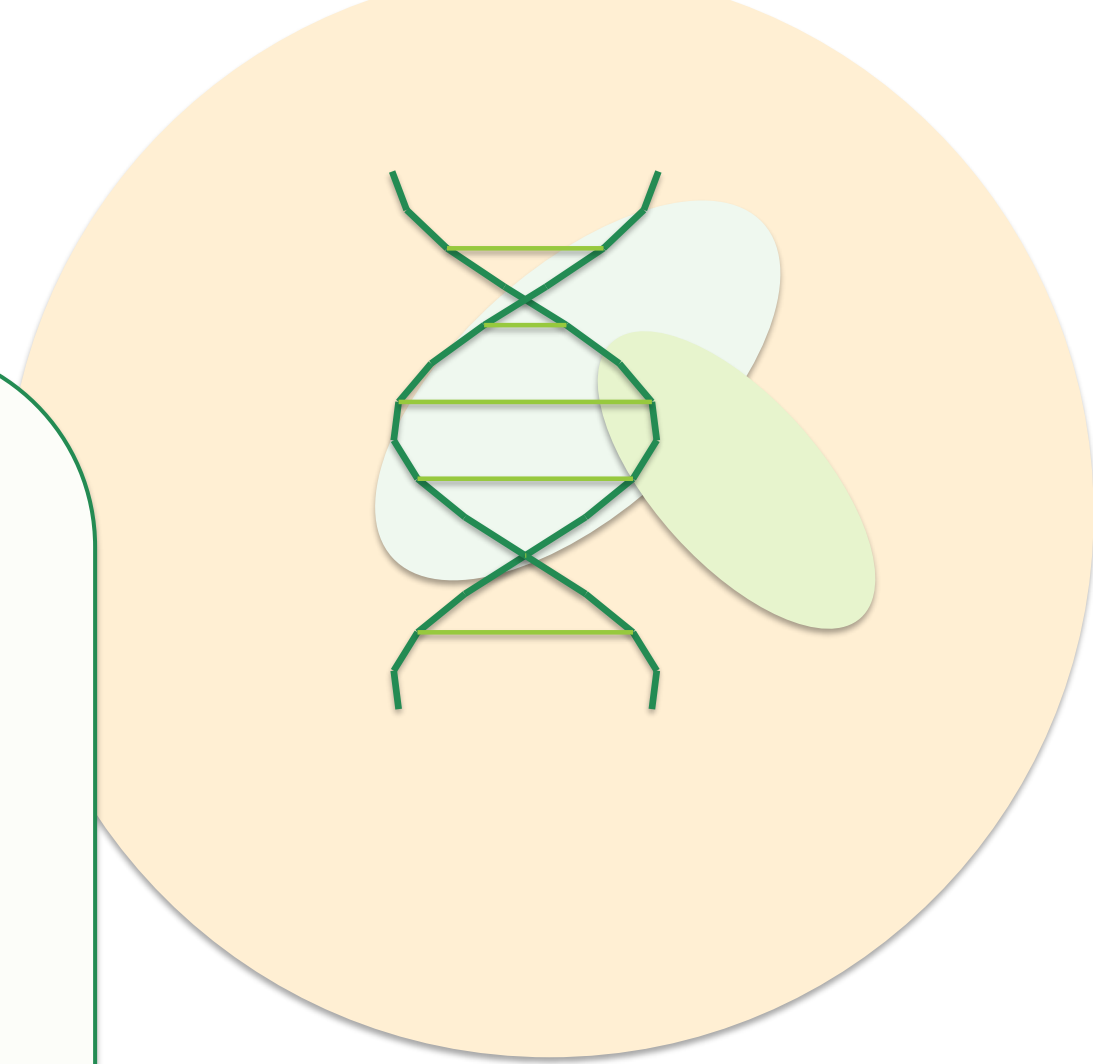
ثاني عشر
أنسابير



SUBJECT

Biology

Learn • Understand • Apply



MENDELIAN GENETICS:

Independent Assortment & Probability

Bio Zone

Presented by: Rania Adel



Beyond a Single Trait

Gregor Mendel **already** established how a **single trait is inherited**. But organisms are made of **thousands of traits**!



How do we inherit multiple traits at the same time? Do the genes for seed color and seed shape travel together, or do they **mix and match**?

Key Term:

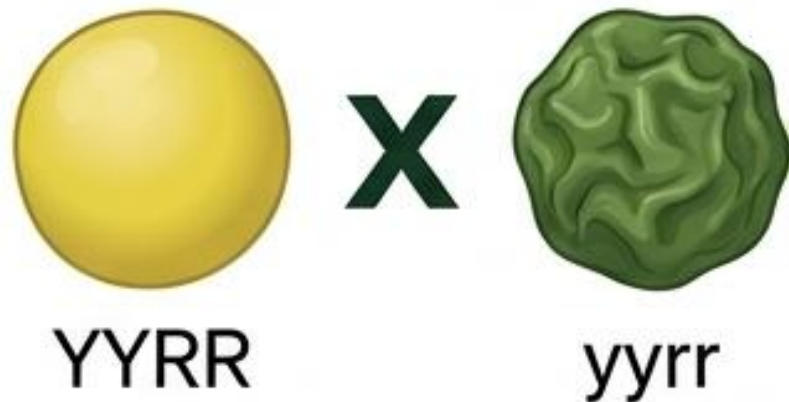
Dihybrid: An organism that is heterozygous for two different traits (e.g., Yellow & Round).

The Law of Independent Assortment

A **random distribution of alleles** occurs during gamete formation. Genes on separate chromosomes sort independently during meiosis.

1. Parental (P) Generation

Dominant Round, Yellow (YYRR) × Recessive Wrinkled, Green (yyrr)



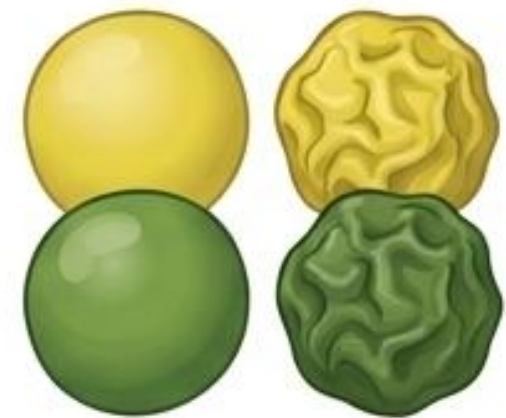
2. F1 Generation

100% Round, Yellow (YyRr). These are Dihybrids!



3. F2 Generation

Mendel allowed the F1 dihybrids to self-fertilize, revealing entirely new combinations of traits!

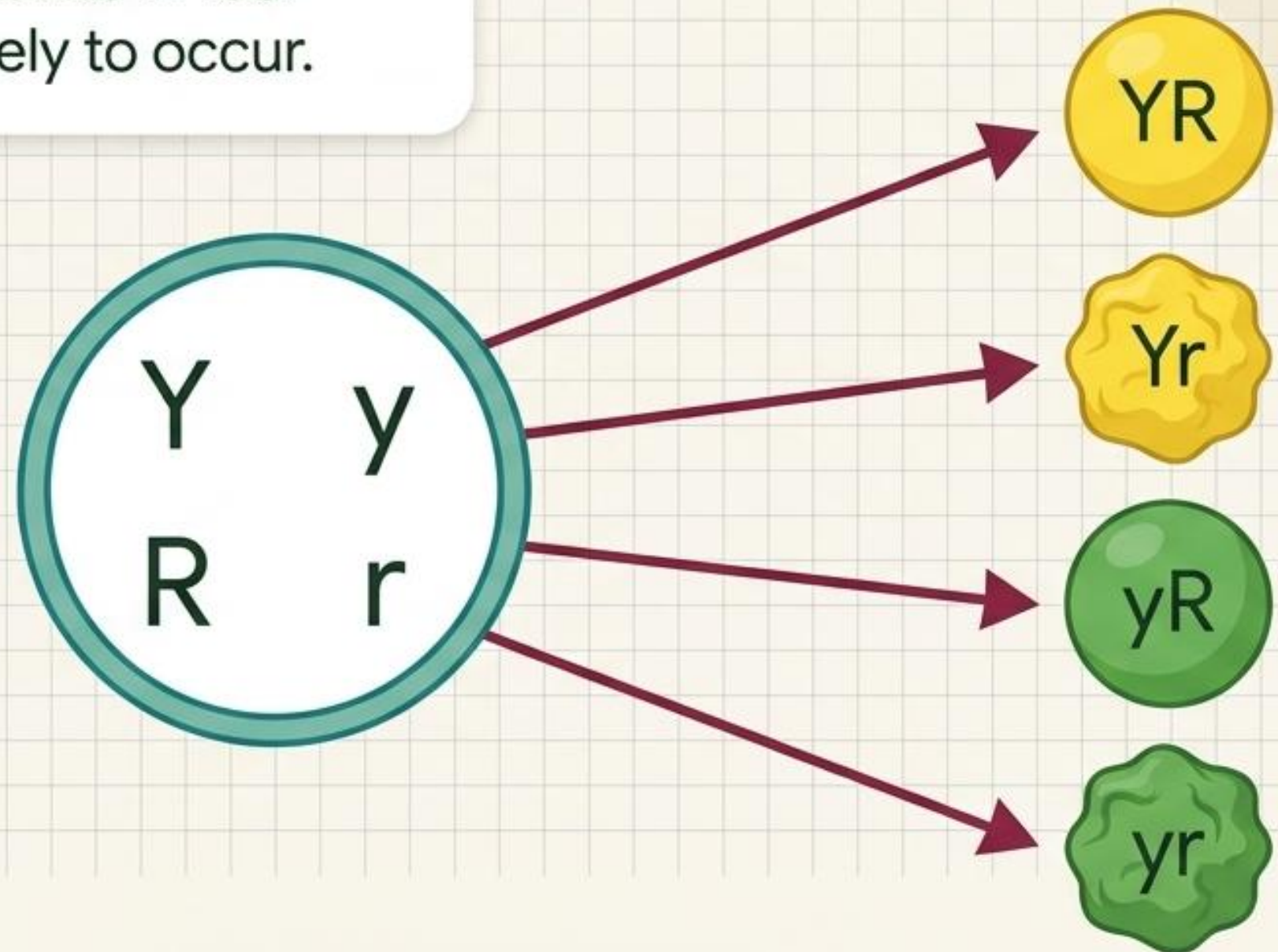


The Random Sorting of Alleles

The random assortment of alleles results in four possible gametes. Each is equally likely to occur.

The 4 Combinations from a YyRr Parent:

- YR (Yellow, Round)
- Yr (Yellow, Wrinkled)
- yR (Green, Round)
- yr (Green, Wrinkled)

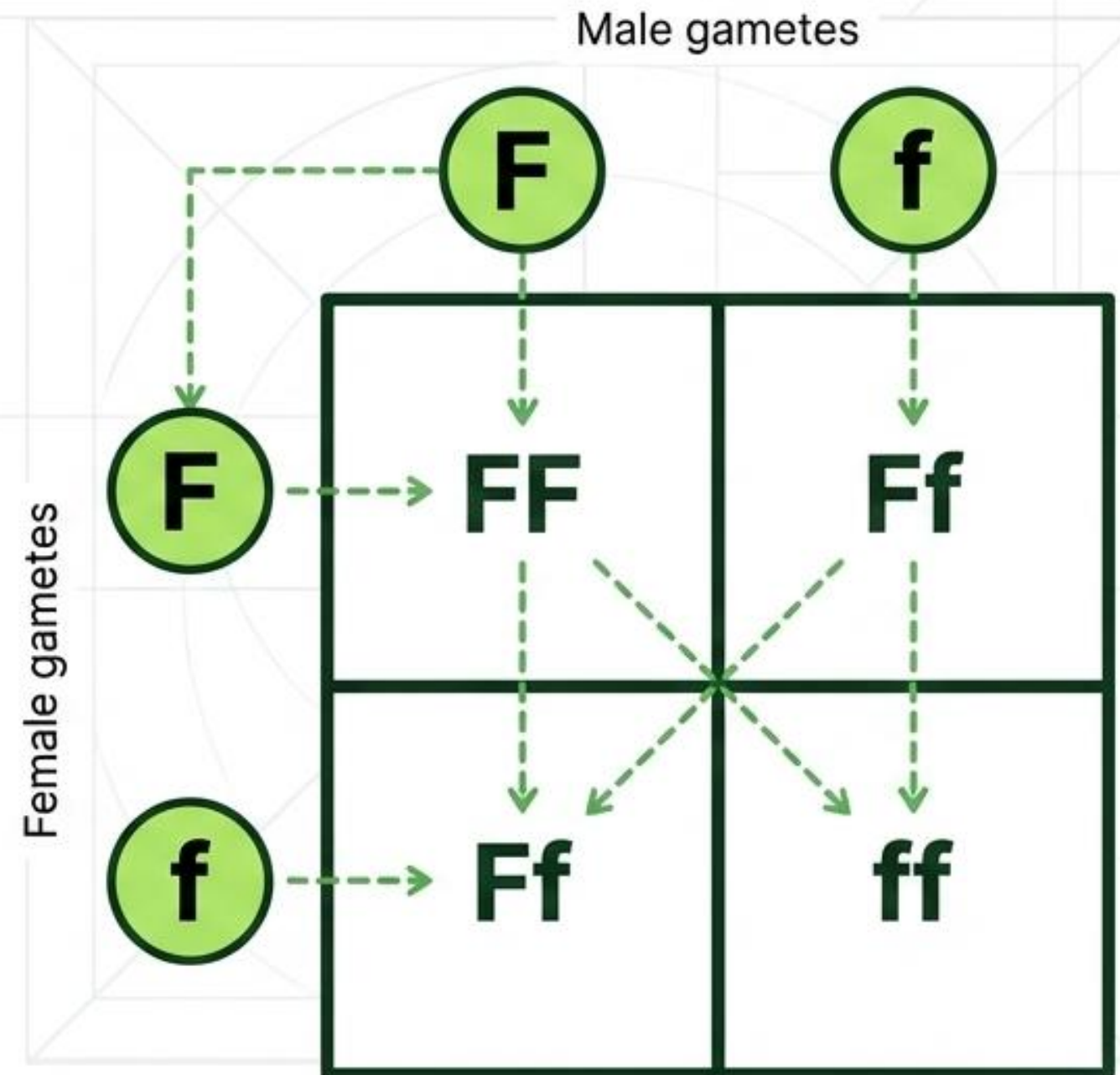


Visualizing Inheritance: The 2x2 Punnett Square

Concept: The number of squares is determined by the types of alleles produced.

Example: 2 allele types $\times$ 2 allele types = 4 squares.

- **Cross:** $Ff \times Ff$
- **Genotypic Ratio:** 1:2:1 (1 FF : 2 Ff : 1 ff)
- **Phenotypic Ratio:** 3:1 (3 Freckles : 1 No Freckles)



The Dihybrid Cross (4x4)

Concept:

Examining the simultaneous inheritance of two traits.

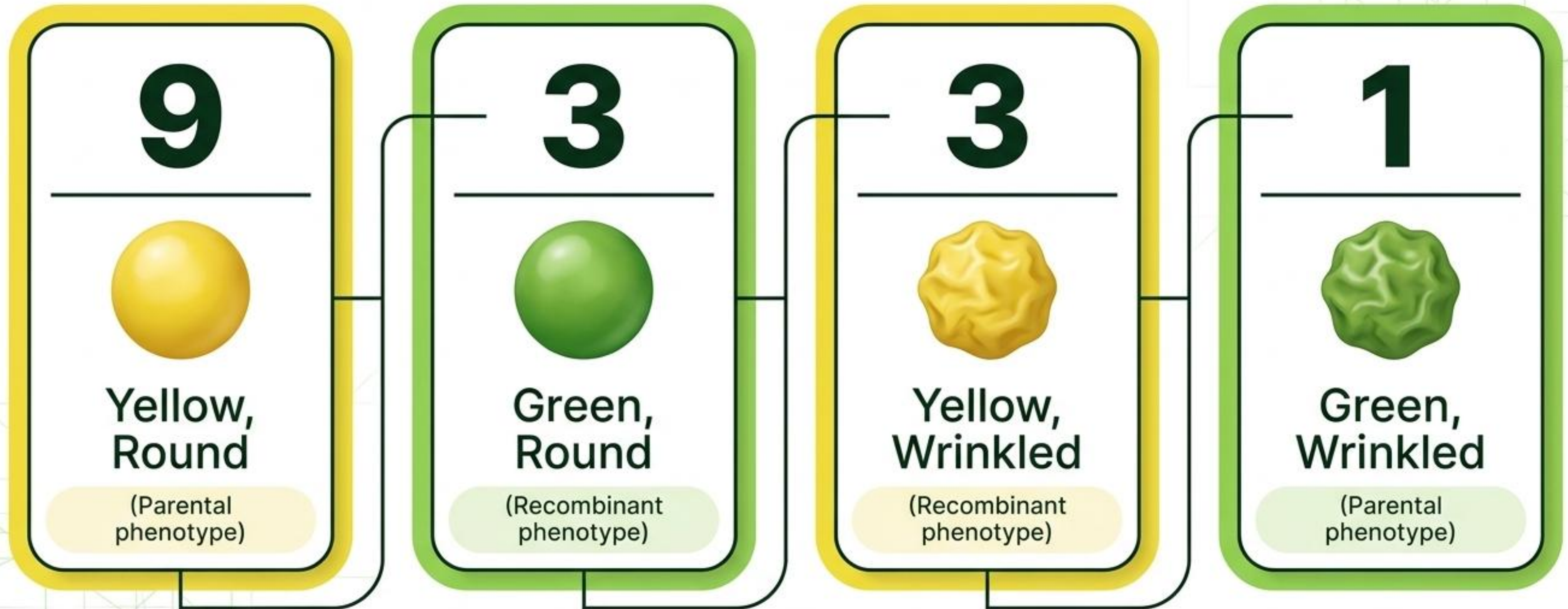
Example:

Crossing two heterozygous F1 plants ($YyRr \times YyRr$).

- 4 different gametes from the male $\times$ 4 different gametes from the female = 16 squares.
- Every square represents a possible genetic combination of both traits.

	YR	Yr	yR	yr
YR	YYRR 	YYRr 	YyRR 	YyRr 
Yr	YYRr 	YYrr 	YyRr 	Yyrr 
yR	YyRR 	YyRr 	yyRR 	yyRr 
yr	YyRr 	Yyrr 	yyRr 	yyrr 

The Dihybrid Phenotypic Ratio: 9:3:3:1



Insight: The presence of recombinant phenotypes (traits mixed in ways the parents didn't have) is the ultimate proof that the genes sorted independently!

Comparing Crosses: Monohybrid vs. Dihybrid

Feature	Monohybrid Cross	Dihybrid Cross
Traits Tracked	1 Trait	2 Traits
Grid Size	2 × 2	4 × 4
Total Squares	4	16
Heterozygous Cross	Aa × Aa	AaBb × AaBb
Phenotypic Ratio	3:1	9:3:3:1

Genetics is a Game of Probability



Explanation: The inheritance of genes works just like flipping a coin.

The Math:

- Probability of heads on one flip = $1/2$
- Probability of heads TWICE in a row = $1/2 \times 1/2 = 1/4$

Connection to Genetics: Actual data might not perfectly match predicted ratios (just like you might get tails twice in a row). However, the larger the number of offspring, the closer the results match the Punnett square predictions!



Quick Check: Test Your Logic

1. If a plant has the genotype $AABb$, what are the possible gamete combinations it can produce?
2. Why is a dihybrid Punnett square exactly 16 boxes?
3. If you roll a six-sided die, what is the probability of rolling a '4' twice in a row? How does this relate to genetics?

(Note: Answers are intentionally hidden and will be revealed in the final Answer Key!)

Practice Questions (MCQs)

1. What does the law of independent assortment state?

- A. Genes on the same chromosome are always inherited together.
- B. Random distribution of alleles occurs during gamete formation.
- C. Dominant alleles always mask recessive alleles.
- D. Gametes contain two alleles for every trait.

2. In a monohybrid cross of two heterozygous individuals ($Ff \times Ff$), what is the expected phenotypic ratio?

- A. 1:2:1
- B. 9:3:3:1
- C. 3:1
- D. 1:1

3. How many different types of gametes can a plant with the genotype $YyRr$ produce?

- A. 1
- B. 2
- C. 4
- D. 16

4. Which of the following represents a homozygous dominant, round-seed pea plant?

- A. $YYRR$
- B. $YyRr$
- C. $yyrr$
- D. $yyRR$

5. What is the probability of a coin landing on heads twice in a row?

- A. $1/2$
- B. $1/4$
- C. $1/8$
- D. $1/16$

6. In a dihybrid cross, how many squares are required in the Punnett square?

- A. 2
- B. 4
- C. 8
- D. 16

Practice Questions (MCQs)

7. What was the phenotype of the F1 generation when Mendel crossed homozygous yellow, round-seed peas (YYRR) with green, wrinkle-seed peas (yyrr)?

- A. Green, round
- B. Yellow, wrinkled
- C. Yellow, round
- D. Green, wrinkled

8. The genotypic ratio of the possible offspring in an Ff x Ff cross is:

- A. 3:1
- B. 1:2:1
- C. 9:3:3:1
- D. 1:1:1:1

9. Which of the following is a possible gamete produced by a parent with the genotype YyRr?

- A. Yy
- B. Rr
- C. Yr
- D. YY

10. If Mendel's predicted phenotypic ratio for a dihybrid cross is 9:3:3:1, what does the "9" represent?

- A. Offspring showing both recessive traits
- B. Offspring showing one dominant and one recessive trait
- C. Offspring showing both dominant traits
- D. The total number of squares in the Punnett square

11. Why might actual genetic data not perfectly match predicted Punnett square ratios?

- A. Punnett squares are fundamentally flawed.
- B. Probability dictates exact outcomes every time.
- C. Predictions become less accurate with larger populations.
- D. Genetics is based on probability, and small sample sizes can skew results.

12. An organism that is heterozygous for two traits is called a:

- A. Monohybrid
- B. Dihybrid
- C. Homozygote
- D. Recombinant

Practice Questions (T/F & Matching)

True or False:

- 13. The larger the number of offspring involved in a cross, the less likely it will match the results predicted by a Punnett square.
- 14. Genes on separate chromosomes sort independently during meiosis.
- 15. A dihybrid cross involves the simultaneous inheritance of two or more traits.
- 16. The gamete combinations YR, Yr, yR, and yr are all equally likely to occur from a YyRr parent.

Matching: Match the term to its correct description.

- | | |
|---------------------------|--|
| 17. Recombinant phenotype | A. The initial parents used in a genetic cross. |
| 18. P generation | B. Examines the inheritance of a single trait. |
| 19. Monohybrid Cross | C. A trait combination found in offspring that was not present in the parents. |
| 20. F1 generation | D. The first generation of offspring, which were all dihybrids in Mendel's experiment. |

Practice Questions (Critical Thinking & HOT)

21. If you cross a YyRr plant with a yyrr plant, which gamete can the yyrr plant produce?

A. YR

B. Yr

C. yR

D. yr

22. In a dihybrid Punnett square, how are the male and female gametes arranged?

A. Male gametes on the inside, female on the outside.

B. Male gametes across the horizontal side, female on the vertical side.

C. Both male and female gametes are written randomly inside the squares. D. Gametes are only written on the horizontal axis.



23. (HOT) In fruit flies, red eyes (R) are dominant to pink eyes (r). What is the phenotypic ratio of a cross between a heterozygous male and a pink-eyed female?

A. 3:1

B. 1:1

C. 1:2:1

D. 9:3:3:1



24. (HOT) What is the probability of rolling a "2" on a six-sided die twice in a row?

A. 1/6

B. 1/12

C. 1/36

D. 1/4



25. (HOT) Based on independent assortment, how does a dominant allele mask a recessive one?

A. It destroys the recessive allele in the gamete.

B. It physically blocks the recessive allele from entering the cell.

C. In a heterozygous genotype, only the dominant trait is expressed in the phenotype.

D. The recessive allele is mutated by the dominant allele.

ANSWER KEY & SOLUTIONS

Quick Check (From Slide 10):

1. AB, Ab (since the first gene is homozygous AA, it only gives 'A').
2. 4 possible male gametes $\times$ 4 possible female gametes = 16 combinations.
3. $1/6 \times 1/6 = 1/36$. This illustrates that genetic inheritance is based on the multiplication of independent probabilities.

MCQ Answers (1-12):

1. B | 2. C | 3. C | 4. A | 5. B | 6. D
7. C | 8. B | 9. C | 10. C | 11. D | 12. B

True/False & Matching (13-20):

13. False (More offspring = more likely to match).
14. True | 15. True | 16. True
17. C (Recombinant)
18. A (P generation)
19. B (Monohybrid)
20. D (F1 generation)

HOT & Critical Thinking (21-25):

21. D (yr is the only possible combination from yyrr).
22. B
23. B ($Rr \times rr$ yields 50% Rr and 50% rr, which is a 1:1 ratio).
24. C ($1/6 \times 1/6 = 1/36$).
25. C (In heterozygotes, the dominant trait determines the expressed phenotype).



Bio zone

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