GENE FLOW, HARDY WEINBERG

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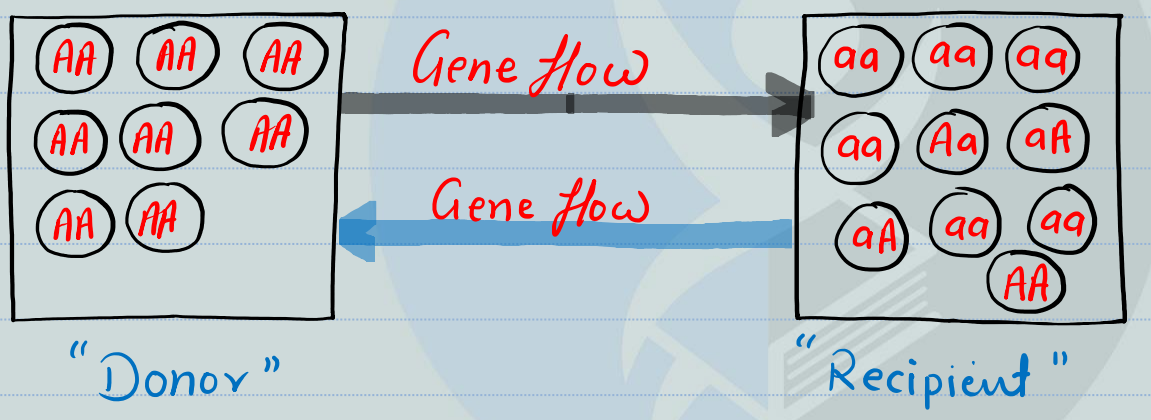
1. Natural selection
2. Genetic drift * (Random)
3. Non-random mating
4. Mutation *
5. Gene flow / migration

Origin new genes / gene families.

Hardy weinberg's Calculation.

Gene flow or migration

- Leads to change in allelic frequency.

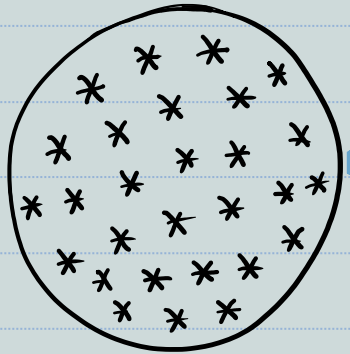


Allelic freq:

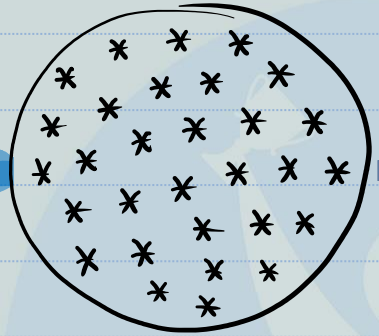
A = 0·25

a = 0·75

"Micro-evolution"



Next gen^{n}.



Multiple gen^{n}.

Macro-evolution

- Morphological diff.
- Reproductive isolation

(Speciation)

"formation of New Species"

- Mutation
- Gene flow
- Non-random mating
- Genetic drift
- Natural selection.

- Mutation
- Gene flow
- Non-random mating.
- Genetic drift.
- Natural selection.

- **Origin of gene and gene family:**

1. Gene duplication
2. Exon shuffling
3. **Unequal crossing over**
4. Mobile elements/**Retro-transposition**
5. Lateral gene transfer
6. Gene fusion/fission
7. Whole genome duplication
8. De-novo gene

1. Gene duplication : formation of copies.

- Unequal crossing over
- Replication – error (slippage error)
- Reterotransposition

↳ Leads increase in gene copy number.

e.g. Amylase (AMY1) gene

2. Exon shuffling : or Gene fusion

"Mixing of exon's", duplicated from genes with diff. function's, can form a new gene.

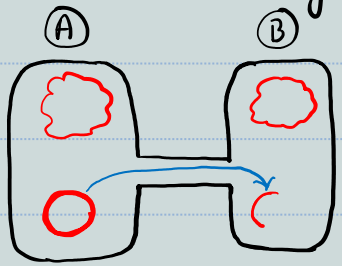
3. Entire genome duplication : (Poly-ploidy)
"Auto-polyploidy"

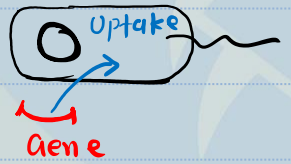
- Commonly observed in plants.

e.g. "Superfamily of transcription factors"

4. Horizontal gene transfer (HGT) : (Bacteria)

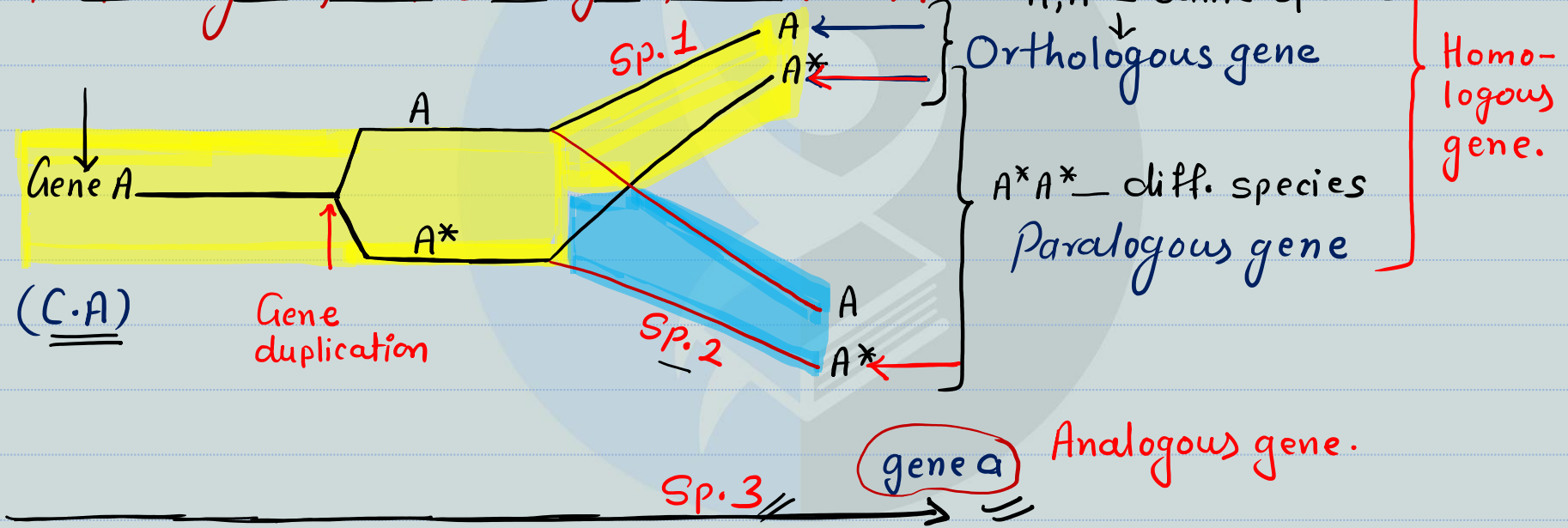
" Genetic exchange bet^n two diff. species of bacterium"





5. De-novo-gene : New gene formation from Non-coding gene.

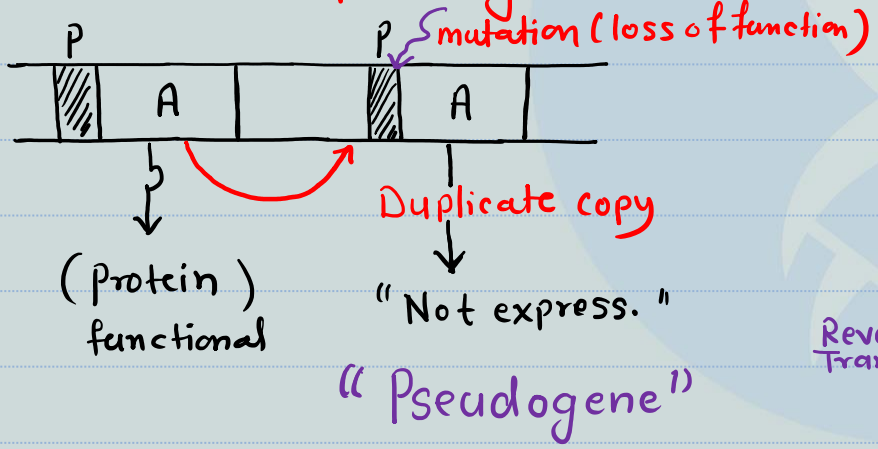
How gene families are get formed ????



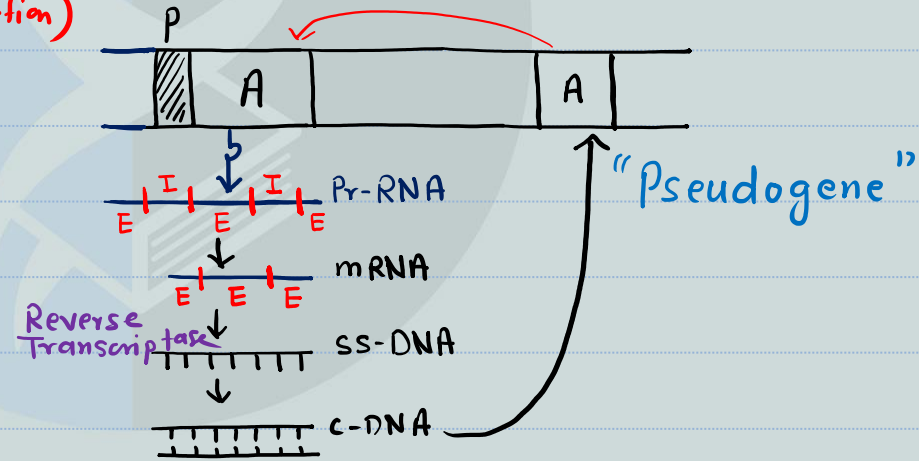
How gene's get dead ??? (How dead gene's are get formed?)

1. Pseudogene : "Duplicate non-functional gene."

1. Classical pseudogene



2. Proccessed pseudogene



Hardy weinberg equilibrium : "Non evolving population"

Assumption's :

- No Natural selection
- No Mutation
- No Genetic drift
- No Gene flow
- Random mating
- * Inbreeding

" Alway's large size population"

The Hardy-Wienberg principle comes from considering what happens when Medelian genes act on population. The model predicts that there will be no change in allele frequencies when (JUNE 2012)

(1) Migration into the population occurs at a steady rate

(2) The population suffers a bottle neck

(3) a rare new mutation is associated with a sharp increase in fitness

(4) no evolutionary process is at work

The Hardy-Weinberg principle states that allele frequencies in a population will remain constant over generations if certain assumptions are met.

A. Random mating
B. Mate choice
C. Small population size
D. Large population size
E. Lack of mutations
F. Directional selection

Which of the above factors will cause changes in allele frequencies overgenerations? (JUNE 2019)

(1) A, D and F
(2) B, D and F
(3) A, C and E
(4) B, C and F

Which of the following would cause deviation from the Hardy-Weinberg equilibrium ?

(1) small population size

(2) random mating

(3) lack of selection pressure

(4) no mutation

Among the following which is not an assumption of Hardy-Weinberg rule

(1) Small population size

(2) Random mating

(3) No natural selection

(4) No mutation

Hardy weinberg : Calculation :

Allelic frequency

A or p dominant allele

a or q Recessive allele.

$$p+q=1$$

Genotype / Individual / frequency

AA p^2 Aa $2pq$ aa q^2

$$p^2+2pq+q^2=1$$

1. Calculate the freq. of dominant allele : "p"
2. ——— " ——— of Recessive allele : "q"

3. freq. of Homozygous dominant : p^2
4. freq. of Heterozygotes : $2pq$ *
5. freq. of Recessive individual : q^2

6. freq. of dominant individuals : $p^2 + 2pq$

e.g. TT Tt → (Tall)

- Frequency ???
- Percentage : freq. x100
- Population size : freq. x N (Total pop. size).

Sample Question:

Recessive individuals 98 out of 200.

Given

$q^2 = \frac{98}{200}$ or $\frac{49}{100}$ or 0.49

$q^2 = 0.49$

$q = \sqrt{0.49}$

$q = 0.7$ $\quad$ $p = 0.3$

$\therefore p + q = 1$

Asked

$2pq =$??? freq.

$= 2 \times 0.7 \times 0.3$

$2pq = 0.42$

EVOLUTION AND ANIMAL BEHAVIOUR

If frequency of one allele is 0.2 and another is 0.8 then number of homozygotes in population of 250 is (assume that population is in Hardy-Weinberg equilibrium)?

(1) 32

(2) 10

(3) 40

(4) 170

Given

$p = 0.2$

$q = 0.8$

$N = 250$

Asked

$p^2 + q^2 = ???$

$2pq = 2 \times 0.8 \times 0.2$

$= 0.32 \times 250$

$=$

250

-80

170

In a population frequency of a homozygous recessive disease is 16% then the frequency of dominant allele would be

(1) 0.84

(2) 0.6

(3) 0.16

(4) 0.4

Given

$q^2 = 16\%$

$q^2 = \frac{16}{100}$ or 0.16

$q = \sqrt{0.16}$

$q = 0.4$

Asked

$P = 0.6$

In a population with two alleles 'B' and 'b' having allele frequency 0.7 and 0.3 in Hardy-Weinberg equilibrium, how many individuals in a sample of 250 can be expected to be heterozygous (Bb)?

(1) 52

(2) 105

(3) 21

(4) 42

Given

B = 0·7

b = 0·3

N = 250

2pq = ??

= 2 X 0·7 X 0·3

= 0·42 X 250

=

42
42
21
105

A population of 200 is in Hardy-Weinberg equilibrium with allele frequency of 'A' = 0.7 and 'a' = 0.3. The number of carriers in population will be

(1) 18

(2) 42

(3) 84

(4) 98

Given

$N = 200$

$A = 0.7$

$a = 0.3$

Asked

$2pq = ???$

$= 0.42 \times 200$

$= 84$

Which of the following populations is not in Hardy-Weinberg proportions?

A. 25% AA, 50% AB, 25% BB = 100

B. 64% AA, 32% AB, 4% BB = 100

C. 81% AA, 18% AB, 1% BB = 100

D. 20% AA, 60% AB, 20% BB ✗ ✓

The allele frequency of C is 0.4 and c is 0.6. If the population is in Hardy-Weinberg equilibrium, what is the frequency of heterozygotes?

(1) 0.16
(2) 0.26
(3) 0.24
(4) 0.48

$C = 0.4$
$c = 0.6$

$2pq = 0.48$

In a gorilla population in Zaire we consider a single gene locus with two alleles G and g, with G dominant to g. If the frequency of the genotype gg is 0.01, then, assuming Hardy- Weinberg proportions, the frequency of the genotype Gg is

A. 0.02

B. 0.09

C. 0.18

D. 0.36

$q^2 = 0.01$

$q = \sqrt{0.01}$

$q = 0.1$

$\therefore p + q = 1$

$p + 0.1 = 1$

$p = 1 - 0.1$

$p = 0.9$

$2pq = 2 \times 0.1 \times 0.9$

$= 0.18$

In a large randomly breeding population of lizards, 75% of the individuals at birth have white stripes; 25% do not have white stripes. If this is a genetic trait governed by a single pair of alleles with the allele for white stripes dominant, assuming Hardy Weinberg proportions, the frequency of the allele for no white stripes is

A. 0.25

B. 0.50

C. 0.75

D. 1.00

$p^2 + 2pq = 75\%$

$q^2 = 25\%$

$q^2 = 0.25$

$q = \sqrt{0.25}$

$q = 0.5$

1

The frequency of a rare recessive trait in a population is 1/10,000. What is the frequency of heterozygous carriers of the recessive allele, assuming Hardy Weinberg proportions?

A. 1%

B. approximately 2%

C. 10%

D. approximately 98%

A population of 1000 individuals are in Hardy-Weinberg genetic equilibrium. If the frequency of one allele is 0.2. What will be the number of heterozygous individuals?

(A) 200
(B) 320
(C) 400
(D) 640

3

In a group of students, about 36% could roll their tongues, a trait determined by a dominant gene (R). The other 64% of the students were non-rollers (r) . The population is in Hardy-Weinberg equilibrium. What is the frequency of the gene R and its recessive allele r?

A) R=0.3 and r=0.1 B) R=0.64 and r=0.36

C) R=0.8 and r=0.2 D) R=0.2 and r=0.8

HAPPY LEARNING

THANKS

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