

c- Six mutations have been located on three cistrons. The complementation test was done between them. The results were as the following table.

+ : it mean complemented

0 : it mean not complemented

Detect the locus of each mutation on the three cistrons and complete the following table?

	1	2	3	4	5	6
1	0	+		+	+	+
2		0	+			+
3			0	0		
4				0		
5					0	+
6						0

Good luck,,,





**Postgraduate Course
Microbial Genetics (602 AGN)**

Answer the following questions تسلم ورقة الأسئلة داخل كراسة الإجابة

Question 1:

(20 marks)

- a- What is the title, the author and the year of publication of the books you used in your seminar?
- b- What are the mutation isolation methods? And the complementation methods are different from fungi and bacteria. Explain?
- c- What are the roles of the transcription factor, hormones and enhancer for gene regulation in Eukaryotes.
- d- What is the difference between complementation and recombination?

Question 2:

(20 marks)

- a- How many plaques can be formed by a three phage particles?
- b- When glucose is absent, is the concentration of cyclic – AMP is high or low?
- c- Name five genetic phenomena mediated by transposable elements?
- d- What is meant by a virulent mutant of a phage?
- e- In the Tn₃ system what enzyme is responsible for formations of cointegrate?
- f- Why can a particular phage not adsorb to any bacterial species?

Question 3:

(20 marks)

- a- Write with drawing about the following:-
 - 1- Initiation of replication and the bacterial origin.
 - 2- The lysogenic program.
 - 3- Phage T4, Mu and phage λ
- b- There are different mechanisms for regulation of gene expression in bacteria. Explain briefly two only of these mechanisms.

(انظر خلفه)



**Postgraduate Course
Microbial Genetics (602 AGN)**

Answer the following questions تسلم ورقة الأسئلة داخل كراسة الإجابة

Question 1:

(20 marks)

- a- What is the title, the author and the year of publication of the books you used in your seminar?
- b- What are the mutation isolation methods? And the complementation methods are different from fungi and bacteria. Explain?
- c- What are the roles of the transcription factor, hormones and enhancer for gene regulation in Eukaryotes.
- d- What is the difference between complementation and recombination?

Question 2:

(20 marks)

- a- How many plaques can be formed by a three phage particles?
- b- When glucose is absent, is the concentration of cyclic – AMP is high or low?
- c- Name five genetic phenomena mediated by transposable elements?
- d- What is meant by a virulent mutant of a phage?
- e- In the Tn₃ system what enzyme is responsible for formations of cointegrate?
- f- Why can a particular phage not adsorb to any bacterial species?

Question 3:

(20 marks)

- a- Write with drawing about the following:-
 - 1- Initiation of replication and the bacterial origin.
 - 2- The lysogenic program.
 - 3- Phage T4, Mu and phage λ
- b- There are different mechanisms for regulation of gene expression in bacteria. Explain briefly **two** only of these mechanisms.

(انظر خلفه)

c- Six mutations have been located on three cistrons. The complementation test was done between them. The results were as the following table.

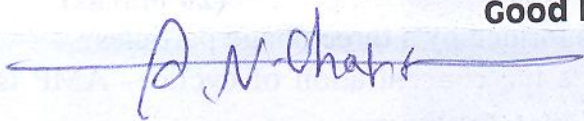
+ : it mean complemented

0 : it mean not complemented

Detect the locus of each mutation on the three cistrons and complete the following table?

	1	2	3	4	5	6
1	0	+		+	+	+
2		0	+			+
3			0	0		
4				0		
5					0	+
6						0

Good luck,,,





Postgraduate Course
Radiation Genetics (AGN 605)

Answer two of the following questions:

Question 1:

(20 marks)

Write a short note on three of followings:-

- a- The effect of radiation on the cytoplasm.
- b- Radiation effects on DNA.
- c- The production and the use of X-rays.
- d- The increase of the cell size under the effect of ionizing radiation.

Question 2:

(20 marks)

Discuss what is meant by the target-hypothesis? And state the evidences that support this hypothesis.

Question 3:

(20 marks)

State and explain what is meant by : environment effect on the action of radiation.

Answer the following question:

Question 4:

(20 marks)

- 1- What is the effect of U.V. radiation on the DNA?
- 2- What the meaning of the following?
 - Photoreactivation
 - Single strand break

Good Luck



جامعة القاهرة
كلية الزراعة
قسم الوراثة

الفصل الدراسي الأول / يناير ٢٠٠٧
زمن الامتحان : ساعتان
العام الجامعي : ٢٠٠٦/٢٠٠٧

مرحلة البكالوريوس
الامتحان النظري النهائي لمقرر وراثة حديثة (٣٠١ ورث)

أجب عن الأسئلة الآتية :

(١٥ درجة)

السؤال الأول :

- ١- التعبير الجيني المتحكم في الناتج الجيني الموجود في الخلية تتوقف علي عاملين أساسيين هما :
-
-
- ٢- هناك بعض الجينات تعرف باسم House keeping gene هذه تعمل بصفة مستمرة ومثل هذه الجينات التي تكون مسئولة عن تخليق RNA polymerase وتحدث تنظيم لناتج الجين في ثلاث مراحل هي :
-
-
-
- ٣- يتكون البروتين المثبط repressor من منطقتين فعاليتين هما :
-
-
- ٤- يتكون أوبرون اللكتوز من ثلاث جينات تركيبية هما :
-
-
-
- ٥- في عملية الـ (Transposable elements) يوجد ثلاث أنواع لعملية القفز هما :
-
-
-
- ٦- توجد طريقتين لقطع انزيم القطع المتخصص للـ DNA
-
-
- ٧- التيلومير هي منطقة طرفية من الكروموسوم بها تركيب خاص يمكنها القيام بثلاثة وظائف هي :
-
-
-
- ٨- عملية صرو تعبئة الـ DNA داخل الكروموسومات تمر بعدة مستويات مختلفة هي :
-
-
-

(١٥ درجة)

السؤال الثاني :

- ١- ضع علامة (√) أو (X) أمام العبارات التالية مع تصحيح الخطأ (٧ درجات)
١- نقص الميلانين هو المسؤول عن حدوث مرض البول الكابتون .
- ٢- أظهرت صور الميكروسكوب الالكتروني أن خلية *E. coli* تحتوي علي منطقتين هما النواه والسيتوبلازم .
(انظر خلفه)

- ٣- لا بد من وجود نوع من الـ DNA متعدد النسخ في الجينوم وسمي Repetitive DNA .
- ٤- القطع المتماثل تكون النهايات لزجة sticky end بينما القطع الغير متماثل تكون النهايات حادة blunt end .
- ٥- الكوسميدات cosmides هي عبارة عن ناقل يجمع ما بين الفاج والبلازميد ويحتوي علي أطراف مفردة من الـ Cos site DNA .
- ٦- في التعبير الجيني في الكائنات مميزة النواه توجد منطقة (Locus control region (LCR هذه تنظم مواقع لازمة للتعبير الجيني لكل الجينات الموجودة علي الكروموسوم بواسطة التتابعات الخاصة به .
- ٧- الـ Transacting هي تتابعات من النيوكلوثيريدات تخلق في مكان وتعمل في نفس مكان تخليقها وإذا انتقلت مكان آخر تكون غير فعالة .

II – أذكر الفرق بين كل من في جدول (٨ درجات)

- ١- جزئ الـ DNA وجزئ الـ RNA
- ٢- الـ Exons والـ Introns .
- ٣- Splicing و الـ Capping .
- ٤- Enhancer المعزز و GC box – CCAAT box .

(١٥ درجة)

السؤال الثالث :

اشرح بالتفصيل الخطوات الأساسية اللازمة لعمل الهندسة الوراثية وما هي الأنواع المختلفة لناقلات الكلوثة مع ذكر انزيمات القطع المتخصصة Restriction enzymes في مجال الهندسة الوراثية - مع الرسم ان أمكن .

(١٥ درجة)

السؤال الرابع : أجب عن سؤلين فقط

- ١- عرف العناصر الانتقالية Transposable elements وكيف تتم خطوات تضاعف هذه العوامل الانتقالية بواسطة الإدماج المشترك .
- ٢- Inborn errors of metabolism أي عيوب الأيض الخلوية تم الدراسة علي هذه الظاهرة التي أوضحت بعض العيوب الوراثية التي تنتج من الطفرات - أشرح هذه العملية بالتفصيل مع ذكر الأمثلة .
- ٣- اشرح بالتفصيل عملية الترجمة Translation في *E.coli* بالمرحل الثلاثة المختلفة مع الرسم ان أمكن .

مع التمنيات بالتوفيق ،،،

أسئلة ٢٠٠٦

Cairo University
Faculty of Agriculture
Department of Genetics



Semester: (June 2007)
Academic year: 2006/2007
Allowed Time: 2 hr

Postgraduate Course
Mutation and Mutagens (604 AGN)

Answer all questions; use diagrams when necessary:

Question 1:

(15 marks)

Write brief notes on 2 points of the following:

- 1- Intragenic and intergenic mutations.
- 2- Actions of UV-light as a mutagen.
- 3- Reverse mutations.
- 4- Functionality of alkylating agents.

Question 2:

(15 marks)

- (a) Temperature is an external factor which may enhance mutation rates, Discuss briefly this factor, give examples if possible.
- (b) Outline the molecular mechanisms which may lead to gene mutations, compare between mis-sense vs. non-sense mutations.

Question 3:

(15 marks)

- (a) Mutator genes play an important role on spontaneous mutation rate, Explain this fact giving a single and a double-unit systems.
- (b) Outline a practical technique for measuring spontaneous and induced mutation rates in sex chromosomes of *Drosophila*.

Question 4:

(15 marks)

- (a) Discuss briefly the actions of ionizing radiations on DNA and on chromosomes leading to gene and chromosomal mutations, use diagrams to explain your answer.
- (b) What is meant by photoreactivation? Give an example for your answer.

Good luck,,,

Prof. Dr. Hashem Hussein



Postgraduate
Genetics (AGN 601)

Answer the questions of only one group

Group I

Answer all the following questions

Question 1:

(20 Marks)

Discusses the differences between:

- Gene regulation in Prokaryote Vs. Eukaryote.
- Cloning Vs. expression vectors.
- Gene mutation Vs. chromosomal aberration.
- Genomic library Vs. cDNA library

Question 2:

(10 Marks)

- Describe in details the methods for recombinant gene detection at DNA, RNA and protein level
- Discuss the role of translation factors.

Question 3:

(15 Marks)

Design experiment to improve the salt tolerance of tomato cultivars using gene transfer and include the following items in your answer:

- How to prepare the expression cassette.
- Suitable method for gene delivery.
- Role of plant tissue culture.
- Molecular confirmation of transformation and evaluation of the transgenic plants

Question 4: (Answer only 2 items from the following) **(15 Marks)**

- a. Describe in details the features of Watson and Crick model of DNA structure.
- b. DNA replication and protein synthesis are polar processes, explain
- c. **Compare between the following:**
 - 1- DNA-dependent DNA polymerases Vs. DNA-dependent RNA polymerases.
 - 2- Structure of mRNA in prokaryotes Vs. eukaryotes.

Group II

Answer all the following questions

Question I:

(30 Marks)

- a- Define DNA nanotechnology
- b- Discuss briefly the types of DNA
- c- Mention all the cases DNA nanotechnology and discuss briefly two of them

Question II:

(30 Marks)

- a- Write short notes on the major contribution of two scientist in the field of behavioral genetics
- b- Define the term Epigenesis
- c- Mention the three methods of study in behavioral genetics
- d- Show how behavioral genetics can be used in social studies

GOOD LUCK

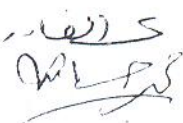
Examination Committee

Professor Dr. Abdel kader Gamal-Eldine

Professor Dr. Mohammed H. Soliman

Evolution Committee

Professor Dr. Hashem Hussein





Postgraduate course
Genetical and Cytological Techniques (701)

Question 1 : (12 marks)

DNA sequencing is one of the most important techniques in molecular biology. Discuss pointing out its significance and the basic strategy used in the automated sequencing technology.

Question 2 : (18 marks)

A) Assume you have a mixture of amino acids- outline an experiment to separate these amino acids using the technique of paper chromatography (6 marks).

B) In your opinion what are the main differences between: *(give answers to only 3 points)* (12 marks)

- 1- A restriction enzyme and the S1 nuclease enzyme
- 2- The BAC and YAC vectors
- 3- SDS-PAGE and PAGIF
- 4- The opposition method and the liquid emulsion method for application of the photographic emulsion in autoradiography.

Question 3 : (15 marks)

A-What are the common characteristics of the fixative compounds. Cite at least two examples for non-metallic fixatives and metallic fixatives compounds?

B-Discuss the most valuable applications of basic chromosome research in the diagnosis of genetic disorders?

Question 4 : (15 marks)

A)- Give a brief account on one of the following items:

- 1-The major factors that determine the yield of anthers that can be used in anther culture
- 2-The mechanism of *Agrobacterium* as mediated gene delivery system into plant cells indicating, why dicotyledonous plants are more susceptible than monocotyledonous plants?

B)- From what you have learned, explain a technique that you can use to transform and express the human alpha-1-antitrypsin gene into specific sheep tissues.

Good Luck

د. / ضياء الدين



Answer the following questions

Question 1 : (20 grades)

- 1) Comment on the main properties of cytoplasmic matrix ?
- 2) Write on the fine structure of Golgi complex ?

Question 2 : (20 grades)

What are the main differences between Four the following :

- a- Spindle microtubules – Ciliary microtubule .
- b- Active transport –enclosure of substances in membranous vesicles .
- c- Desmosomes – gap junction
- d- Integral portions – Peripheral proteins
- e- L – type — S -type microfilaments .

Question 3 : (20 grades)

- A) How do the Light- dependent reaction proceed ?
- B) How DNA and histones are organized in Chromosomes ?

Good Luck



Molecular Genetics
Post-graduate Exam (2006-2007)

Answer all the following Questions:

Time: 2 hours

- 1- Talk about the following items:
 - a) Different mutations affecting the gene regulation of gene expression in *lac*-operon, how could we identify the dominant from recessive mutations? Give examples.
 - b) The effect of the leader region on *trp*-operon on its regulation.
 - c) The influence of histones on gene expression.
- 2-
 - a) How the RNA processing control regulates the production of mature RNA molecules from precursor-RNA molecules?
 - b) Give an example for how to find a specific clone in a genomic library.
 - c) Homologous search plays an important part in assigning gene function except ORFs with no matches to database, explain.
- 3-
 - a) Talk about the roles of chromosome walking and chromosome jumping in identifying a specific gene between flanking markers.
 - b) What is DNA fingerprinting? How could this method be used to establish parentage and in forensic science laboratories?
 - c) Many cellular functions are carried out by proteins that contact one another. Design an experiment to find genes that encode proteins that interact with a known protein.
- 4-
 - a) What are the differences between VNTRs and STRs?
 - b) How could we use the microarray to identify SNPs?
 - c) Give examples of some products produced by biotechnology companies?



**Postgraduate Course
Population Genetics (603 AGN)**

Answer only 4 out of the following questions

Question 1: (15 marks)

Define the following expressions, give hypothetical examples:

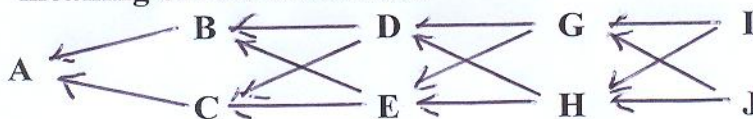
- The effective breeding size of a population in the successive generations. How to calculate it in case of a different sex ratio?
- The adaptive value (fitness) of genotypes in a population and its relation with the coefficient of selection (s). Give examples according to the degree of dominance between the alleles of a given gene under test.

Question 2: (15 marks)

- In the human population, the frequency of albinism is one in each 90000 individuals. Calculate:

- The number of generations required to reduce this frequency to half its value. Explain, how can we achieve this?
- The frequency of heterozygotes in the initial population.

- Calculate the coefficient of inbreeding of the individual A whose ancestors appear in the following diagram. Define the meaning of this coefficient.



- Calculate also Coefficient of relationship between B & C.

Question 3: (15 marks)

Explain the effect of linkage between two genes on the speed to reach equilibrium in a Mendelian population. Use diagrams if possible. Compare with independent assortment (Give examples).

Question 4:

(15 marks)

In a sample from Giza population, the following frequencies of blood groups were surveyed:

A = 2000, B = 1600 ; AB = 600 and O = 1500.

Calculate the gene frequencies and explain if the population is in equilibrium (compare χ^2 test and Weiner coefficient).

D.F. $\frac{1}{3.84}$ $\frac{2}{5.99}$ $\frac{3}{7.81}$ $\frac{4}{9.49}$
 χ^2 (tabulated) =

Question 5:

(15 marks)

What are the various mechanisms that may account for polymorphisms in natural populations?

Good luck,,,

Examiner



Prof. Dr. Hashem Hussein



Postgraduate Course
Population Genetics (603 AGN)

Answer all questions:

Question 1:

(15 Points)

- (a) Explain the simplified conditions specified for the idealized population. Diagram a large base population ($N = \infty$) subdivided into sub-populations or lines in successive generations. What are the consequences of this case?
- (b) What are the mechanisms that may account for polymorphisms in different populations? Explain each one.

Question 2:

(15 Points)

1. Define the following expressions, Give examples if possible:
 - (a) Fixation of a gene
 - (b) Selection favouring heterozygotes.
 - (c) Fitness and Dominance.
2. Explain the role of inbreeding on equilibrium in an idealized population.

Question 3:

(15 Points)

- (a) In the human population, the frequency of albinism is one in each 9000 individuals. Calculate:
 - 1- The number of years required to reduce this frequency to $\frac{1}{2}$ its value, if generation interval is 25 years.
 - 2- The frequency of heterozygotes in the initial population.
 - 3- How this reduction can be reached?
- (b) In a sample from a human population, the following frequencies of blood groups were surveyed:
 $A = 2000$, $B = 1600$; $AB = 600$ and $O = 1500$.
 Calculate the gene frequencies and explain if the population is in equilibrium or not, if not give possible reasons.

D.F.	1	2	3	4
χ^2 (Tabulated) =	3.84	5.99	7.81	9.49

 compare χ^2 test and Weiner's coefficient.

Question 4:

(15 Points)

- (a) An initial population ($F_0 = 5000$ individuals) exposed to random genetic drift being of the sizes: 50, 30, 150 and 300 during the successive generations; calculate the effective breeding size (N_e) and the mean rate of inbreeding (ΔF) during this process.
- (b) A population of cod-fish was left for random mating with the size of 20 pairs of parents per generation, calculate the inbreeding coefficient in this population after 5 generation.

Good luck

Examiner

Prof. Dr. Hashem Hussein

Biochemical Genetics
Postgraduate Exam (2007-2008)

Answer all the following Questions:

Time: 2 hours

- 1- a) Draw a schematic representation of the organization of DNA replication and define the functions of the enzymes and proteins involved.
b) Talk about the role of repetitive DNA in genome organization and in preventing chromosome shortening during replication.
c) RNA processing is performed in eukaryotes only. Talk about the different processing mechanisms for the maturation of RNA.
- 2- a) There is a correlation between gene expression and chromatin structure, explain.
b) There are two main groups of chaperons, identify the function of each group and explain how ubiquitin marks protein for degradation?
c) In Eukaryotic organisms, there are some genes that are strictly regulated by a developmental program while others are environmentally regulated, give examples.
- 3- a) Regulation of gene expression could be affected by initiation of protein synthesis in the cytosol, give example.
b) Extensive DNA damage can be repaired by different mechanisms, discuss two methods of repair mechanisms.
c) Explain how chloroplast protein synthesis is regulated by light.
- 4- Talk in details about the followings:
 - a) Cis-acting elements within genes
 - b) Glycine betaine and osmoprotection
 - c) Impact of water deficit and salinity on transport across plant membranes.

☺☺☺ Good luck ☺☺☺