PRACTICAL TEST 3

Answer Key

GENETICS AND CELL BIOLOGY

Total Points: 50

Duration: 90 minutes

TASK I. (35 points)

Part I. (20 points)

Table 1. (9 points = 0.2 × 45)

<Table 1> GUS expression, after treatment with different concentrations of hormone H, in transgenic plants containing various deletions within the gene X promoter

Plants	Measured fluorescence [value from 1)-5]	Amount of MU* produced by 50 μL plant extracts [nmole MU, value from 1)-6]	Measured absorbance at 595 nm [value from 2)-3]	Amount of proteins* in 50 μL plant extracts [μg, value from 2)-4]	GUS activity* [nmole MU/μg protein/min, value from 3)-1]
WT-0 (control)	600-900	26.5-38.5	0.5-0.7	51.8-71.4	0.04-0.07
WT-1	6,000-9,000	242.5-362.5	0.5-0.7	51.8-71.4	0.34-0.70
dA-1	6,000-9,000	242.5-362.5	0.5-0.7	51.8-71.4	0.34-0.70
dAB-1	600-900	26.5-38.5	0.5-0.7	51.8-71.4	0.04-0.07
dABC-1	600-900	26.5-38.5	0.5-0.7	51.8-71.4	0.04-0.07
WT-100	600-900	26.5-38.5	0.5-0.7	51.8-71.4	0.04-0.07
dA-100	6,000-9,000	242.5-362.5	0.5-0.7	51.8-71.4	0.34-0.70
dAB-100	600-900	26.5-38.5	0.5-0.7	51.8-71.4	0.04-0.07
dABC-100	600-900	26.5-38.5	0.5-0.7	51.8-71.4	0.04-0.07

1. A correct answer for each measurement or calculation within ranges indicated in the Table 1 is worth of 0.2 point.

Q1.1. (4 points = 0.5 x 8)

Plant treated with hormone H	Effect of hormone treatment in plants	
	Stimulation	No effect
WT-0	Control	
WT-1	√	
dA-1	√	
dAB-1		√
dABC-1		√
WT-100		√
dA-100	√	
dAB-100		√
dABC-100		√

1. Answers that are not supported by the GUS activity data in Table 1 will be considered as wrong answers.
2. Plural choices for each hormone-treated plant are null.

Q1.2. (6 points = 2 x 3)

Region in gene *X* promoter	Function (enhancer, silencer, or minimal promoter)		
	enhancer	silencer	minimal promoter
A		√	
–B	√		
C			√

1. An answer that is not supported by the data in Table 1 and **Q1.1** will be considered as a wrong answer.
2. Plural choices for each promoter region are null

Q1.3. (1 point)

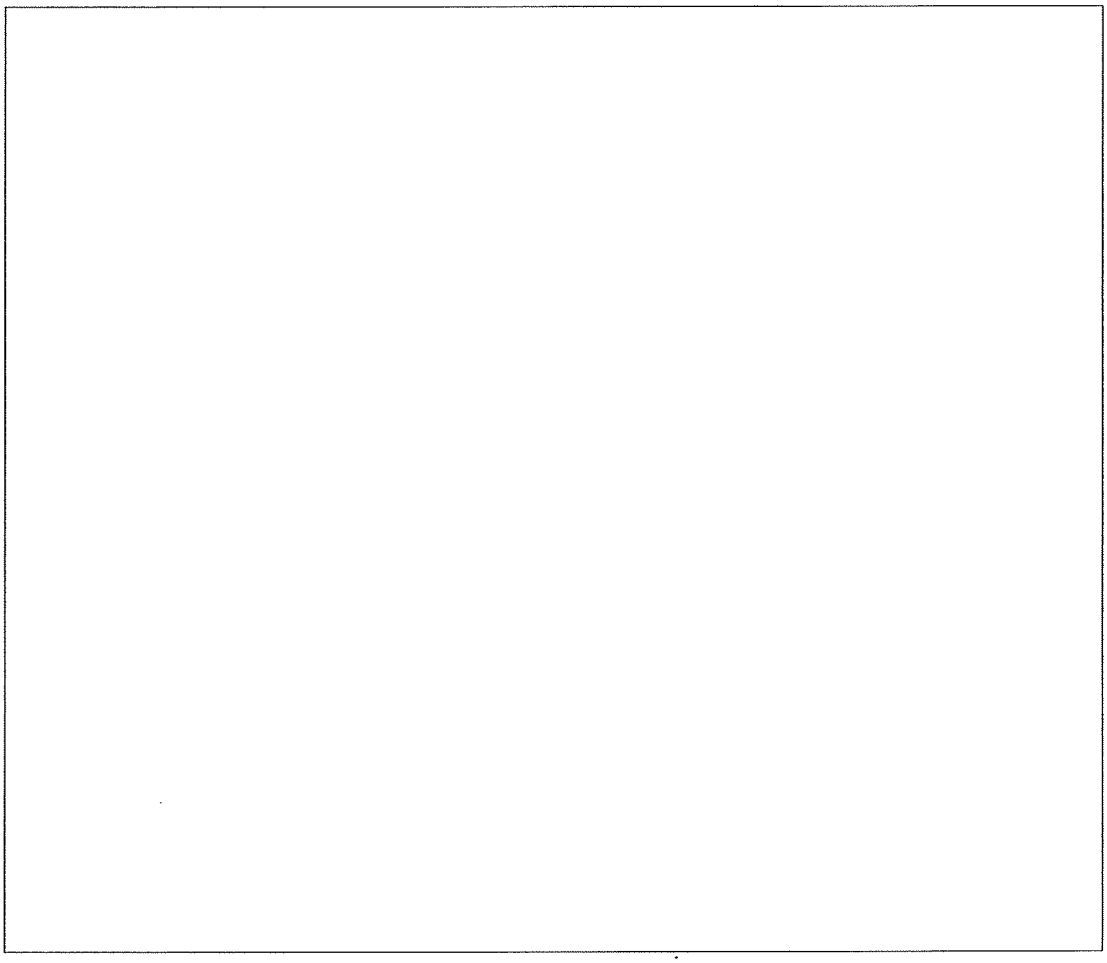
Action mode	
Transcriptional positive feedback regulation	
Transcriptional negative feedback regulation	√

1. The answer that is not supported by the answers for WT-0, WT-1 and WT-100 in Table 1 and **Q1.1** will be considered as a wrong answer.

Part II. (15 points)

Q2.1. (3 points)

<Attach the agarose gel picture here>



1. **3 points** :
   At the least one of the two DNA marker lanes was loaded, together with ALL of the plant samples.
2. **2 points** :
   1) Both marker lanes were loaded but one of the plant sample is missing.
      Or
   2) All plant samples were loaded but both of the marker lanes are missing.

   In all cases, electrophoresis should be performed long enough to allow the genotyping. Otherwise no point will be given.

Q2.2. (4 points = 0.5 x 8)

Plant	Size of the DNA fragment(s) (kb)			Genotype			Phenotype
	0.4	0.6	1.0	*YY*	*Yy*	*yy*	
Plant 1			√	√			Wild type
Plant 2			√	√			Wild type
Plant 3	√	√	√		√		dwarf
Plant 4	√	√	√		√		dwarf
Plant 5			√	√			Wild type
Plant 6			√	√			Wild type
Plant 7			√	√			Wild type
Plant 8	√	√				√	dwarf

Q2.3. (2 points)

Characteristic of the mutation	Dominant	√
	Recessive	

Q2.4. (2 points)

Probability of dwarf offspring	50 (%)

Q2.5. (4 points = 2 x 2)

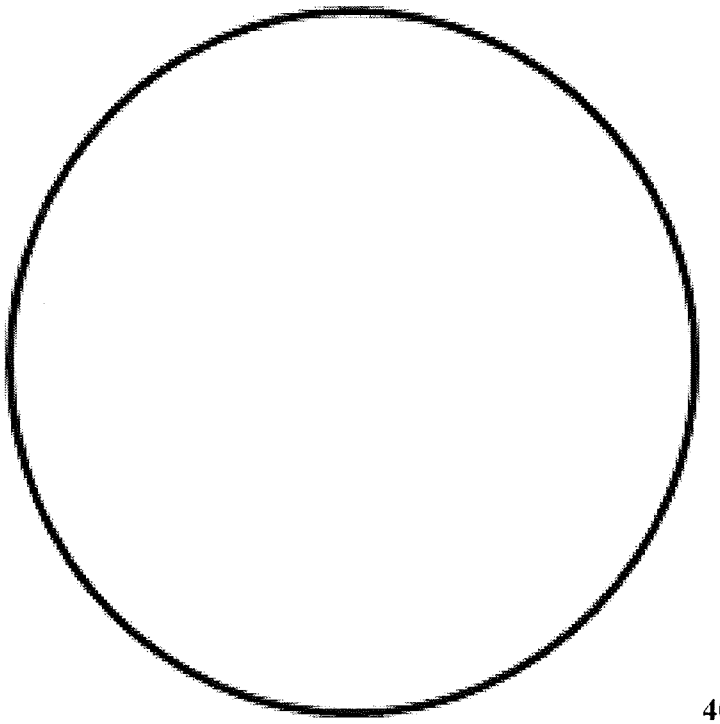
Number of heterozygous (*Yy*) offspring	3750
Number of dwarf offspring	4375

TASK II. (15 points)

Q3.1. (1 point)

synergid cells	
egg cells	
megaspore mother cells	
pollen (microspore) mother cells	√
pollen	
antipodal cells	

Q3.2. (8 points)



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1. 8 points will be given if a cell undergoing meiosis with proper chromosome is drawn and photo evidence is available.
2. 4 points will be given if drawing is good but photo evidence is not available.
3. 2 points will be given if only anther wall cell(s) were drawn.
4. 0 point will be given if i) no cell is drawn, ii) no chromosomes is discernable, iii) only cell debris are drawn.

Q3.3. (4 points)

Meiosis I				Meiosis II			
Prophase	Metaphase	Anaphase	Telophase	Prophase	Metaphase	Anaphase	Telophase
√							

1. 4 point will be given if the meiotic stage drawn in Q3.2 is correctly checked.

Q3.4. (2 points = 1 × 2)

	The amount of DNA	
	The cell undergoing meiosis	Cells constituting anther wall
1C		
2C		√
3C		
4C	√	

C: the amount of DNA in a haploid complement