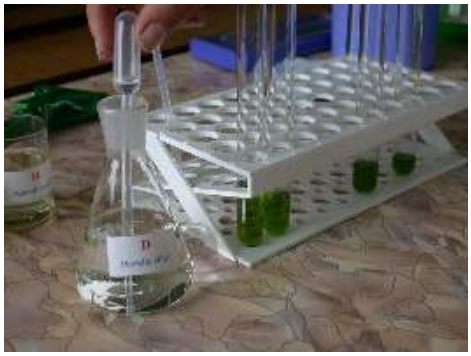
4.2 The correct answers to the practical tests.

4.2.1 Laboratory «PLANT PHYSIOLOGY, MORPHOLOGY AND ANATOMY».





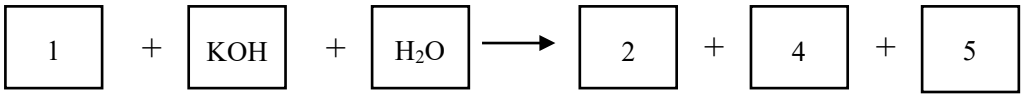
Transfer 3 ml of pigment solution from flask A into tubes № 1 and № 2. Add five drops of 20% KOH from flask B and 1 ml of H_2O (from flask C) to the tube № 1 and to the tube № 2 - only 1 ml of H_2O.



Add 1 ml of the petrolium ether (from the flask D) to the tubes № 1 and № 2, shake well and leave to stand until the fractions separate completely.

Task 1

1.1.



1.2.

1.3.

№1 B

№2 D

Tube №	Reagent	Experiment 1.1.	Experiment 1.2.
		Ethanol fraction colour	Petrolic ether fraction colour
1	KOH	C	D
2	H_2O	C	C





Add 3 ml of the pigment extract to the tube № 3 (flask A) and add 5 drops of HCl (flask E). Mix the tube contents thoroughly by shaking and note the colour change. Add 1 ml of the saturated $(CH_3COO)_2Zn$ solution (from the flask F) to the same tube. Heat the solution on the water bath. Mix by shaking, note the colour change.







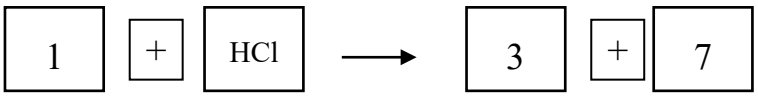


Add 2 ml of the pigment extract and 2 ml of ascorbic acid (flask H) to the tube № 4. Mix by shaking until the colour changes.

1.4.

Reagent	Solution colour in the tube
HCl	F
$(CH_3COO)_2$ Zn	C

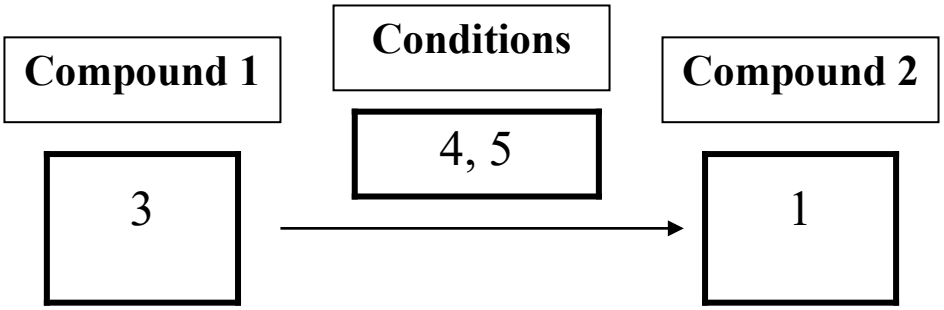
1.5.



1.6.

Extract colour before reaction	Solution colour after reaction
C	D

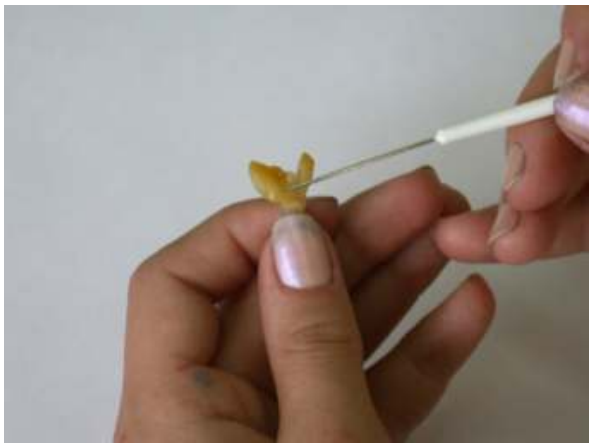
1.7.



1.8.

Compound №	Colour before reaction	Colour after reaction
1	H	H
2	C	D





Study the morphology of flowers A, B, C. Using formula numbers (1-14) from the list below, indicate the correct formulas for each flower in the answer sheet.

Task 2.

2.1.

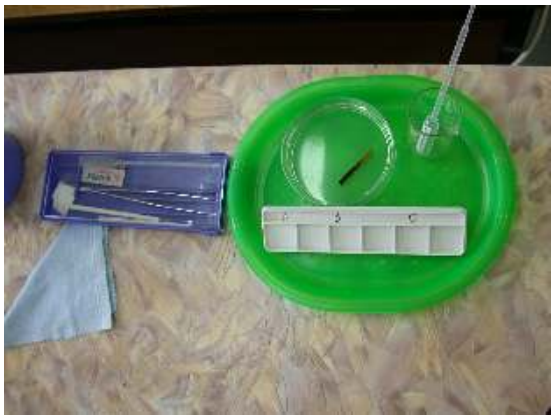
A	B	C
11	6	8

2.2.

A	B	C
1	4	1

2.3.

A	B	C
7	3	4



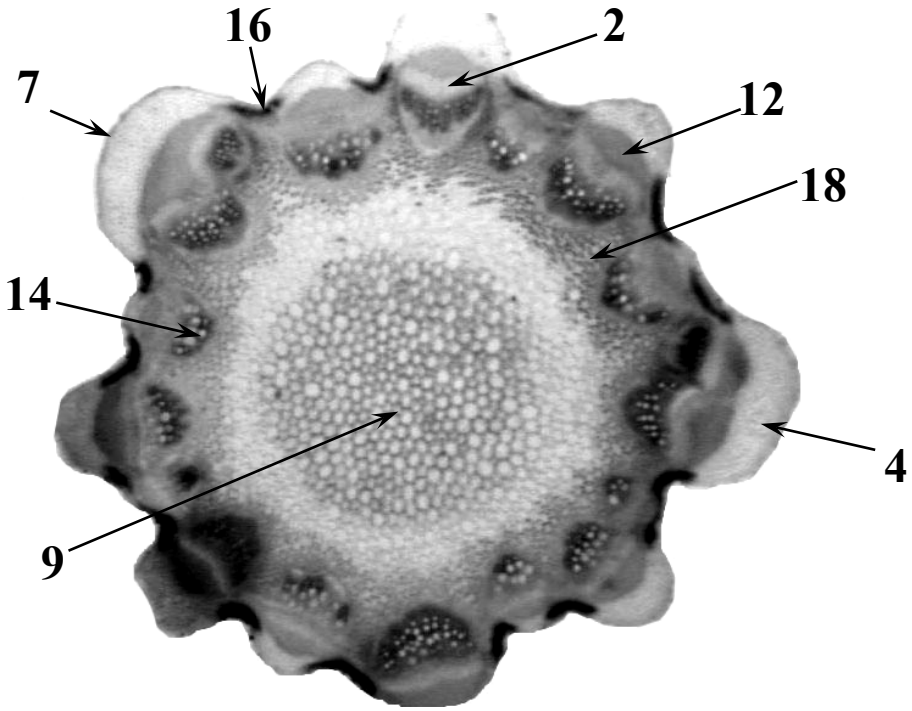


Prepare a cross cut of the object you are given. Colour this cross cut with phloroglucine and add several drops of HCl. Wash the preparation thoroughly with water after 2-5 minutes and then cover it with a cover slip. Observe the preparation under the microscope. Compare the crosscut you just prepared to the schemes 1-6 below and determine which scheme it corresponds to.



Task 3.

3.1



3.2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
				+	+						+		+				

3.3
3

3.4
2

3.5
5

3.6
3

4.2.2 Laboratory «ANIMAL MORPHOLOGY, ANATOMY AND SYSTEMATICS».





You need to observe the details of animal's segmentation, to find its body parts and sequentially detach the appendages (excluding antennula [antenna 1]) from one side of animal's body, assembling them in order on a plate with the help of pins. Then it is necessary to determine the function of each appendage and write it down in the answer sheet.





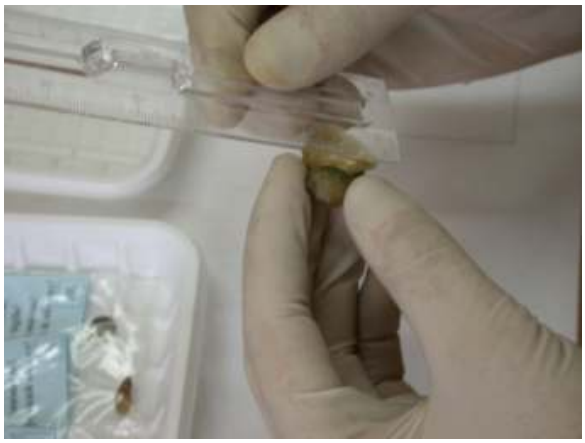
Task 1.

Pedes (extremities)			
№	Functions		
1.	● sensory	○ respiratory	○ reproductive
2.	○ swimming	● food grinding	○ respiratory
3.	● transferring food to mouth	○ respiratory	○ reproductive
4.	○ reproductive	○ transferring food to mouth	○ sensory
5.	○ transferring food to mouth	○ walking	○ defence/attack
6.	○ defence/attack	○ transferring food to mouth	○ reproductive
7.	○ reproductive	○ swimming	● respiratory
8.	○ swimming	● capturing and holding food	○ reproductive
9.	○ reproductive	● respiratory	○ defence/attack
10.	○ reproductive	● walking	○ sensory
11.	○ reproductive	○ transferring food to mouth	● walking
12.	● walking	○ food grinding	○ sensory
13.	○ walking	○ reproductive	○ defence/attack
14.	○ walking	○ respiratory	● reproductive
15.	○ defence/attack	● swimming	○ walking
16.	● swimming	○ food grinding	○ respiratory
17.	○ reproductive	○ sensory	● swimming
18.	● swimming	○ transferring food to mouth	○ respiratory

Task 2.

№	Code		
	Phylum	Subphylum/Class	Genus
I	B	f	7
II	F	b	10
III	D	a	3
IV	H	k	5
V	B	d	4
VI	B	f	8
VII	D	e	6
VIII	E	j	2
IX	B	c	1
X	A	g	9





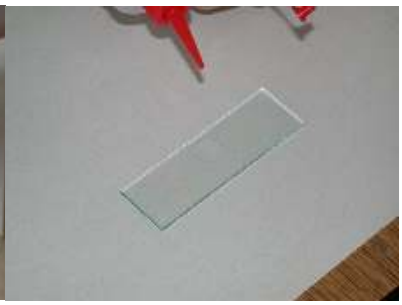
Classify the molluscs you are given and place the numbers written on their shells next to species names in the table in the answer sheet.

Task 3.

Species name	Shell number
	6
Viviparus contectus	**2**
Bithynia tentaculata	**5**
Physa fontinalis	
Aplexa hypnorum	**1**
Radix ovata	**7**
Radix auricularia	**9**
Lymnaea stagnalis	**3**
Planorbarius corneus	**10**
Planorbis planorbis	**4**
Segmentina nitida	

4.2.3 Laboratory «MICROBIOLOGY AND BIOTECHNOLOGY».





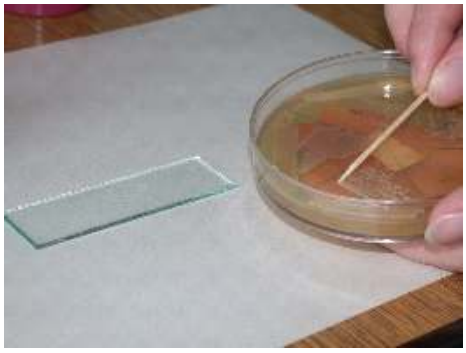
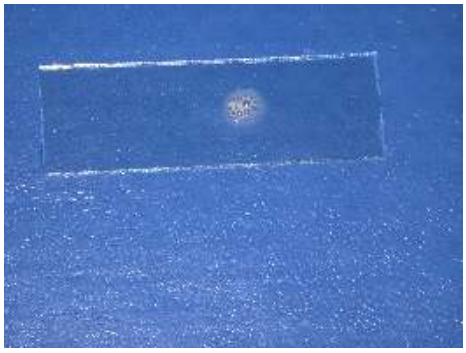
Using a dropping bottle, put a small drop of the 3 % KOH solution onto a glass slide. Using a toothpick, transfer some biomass (roughly 3-4 mm in diameter) of one strain to the KOH drop, trying not to transfer the agar. Mix the bacterial mass with the KOH solution thoroughly. If the mass sticks to the toothpick and moves behind it, the strain is Gram-negative, otherwise – Gram-positive. You can repeat the test if results are not clear

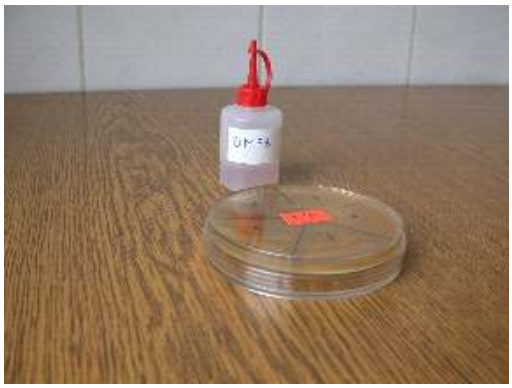


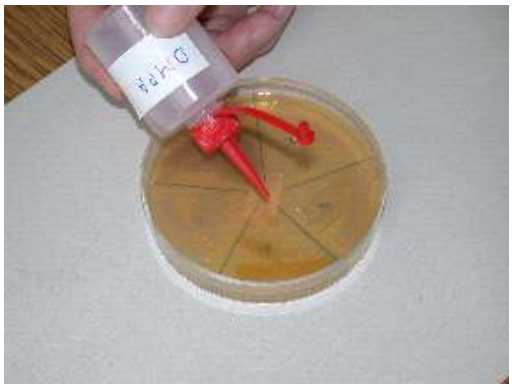




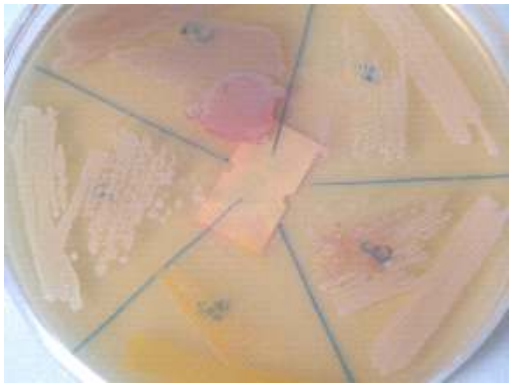

Using a pipette, put a drop of hydrogen peroxide solution onto a glass slide. Using a toothpick, transfer some biomass of one strain from the GCO plate to the drop, trying not to transfer the agar. Mix bacterial mass with the hydrogen peroxide solution thoroughly. Register the results while mixing the bacteria with the solution. Repeat the manipulation with the remaining strains





Using a dropping bottle, put a drop of DMPA onto each colony. 30-60 seconds later the colonies of oxidase-positive strains turn dark red (pink).





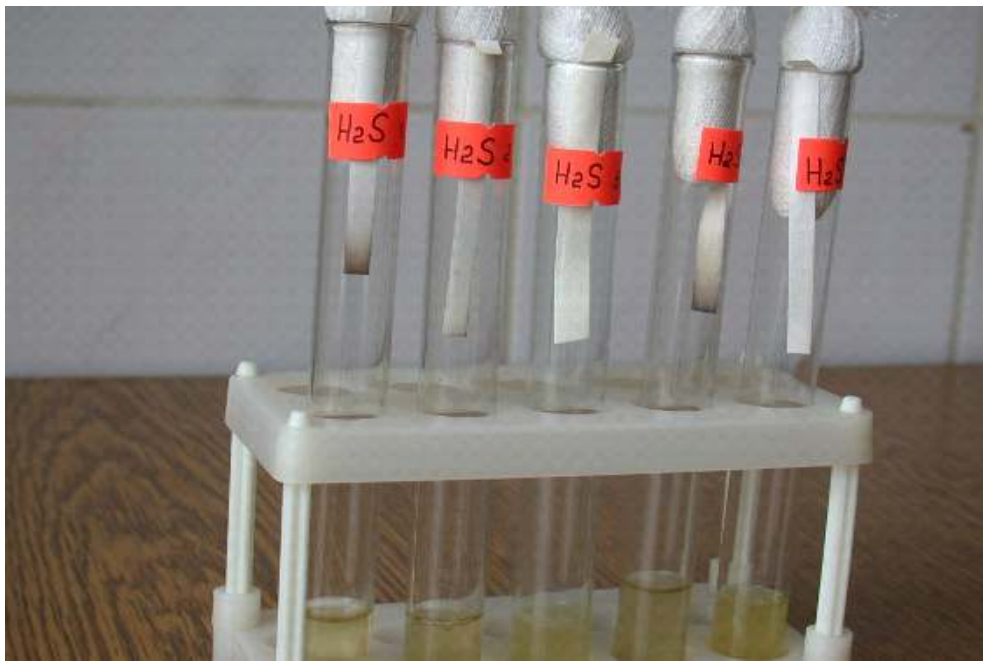
For determination of proteolytic activity you have to analyse a Petri dish with media containing casein, inoculated in advance with strains № 1-5. This plate is labelled "protease".





The plate labelled "amylase" contains rich solid medium supplemented with 0.2% of starch and has been inoculated with strains № 1-5 in advance. Cover the surface of this plate with Lugol's solution (Lugol) and determine which bacteria have the amylolytic activity





Here you have to analyse five tubes prepared before. The tubes contain meat broth and were inoculated with test strains some time before. The tubes also contain pieces of white indicator paper saturated with the solution of lead acetate





Add 1 ml of the 1% Griess reagent to the to suspension of bacteria. The presence of nitrate reductase activity results in the appearance of red colour within 1 minute.



Task 1.

Strain	Gram reaction	O\ F-test	The presence of:						Result of identification
			catalase	oxidase	protease	amylase	H_2S production	nitrate	
1	+	F	+	_	+	+	+	-	M
2	_	F	+	-	+	_	+	+	A
3	_	O	+	+	+	_	_	_	H
4	-	O	+	+	-	-	+	+	K
5	-	O	+	+	+	-	-	+	L

1.3.1. **B**

1.4.1. **A, F**

1.7.1. **D, J**

1.7.2. **B**

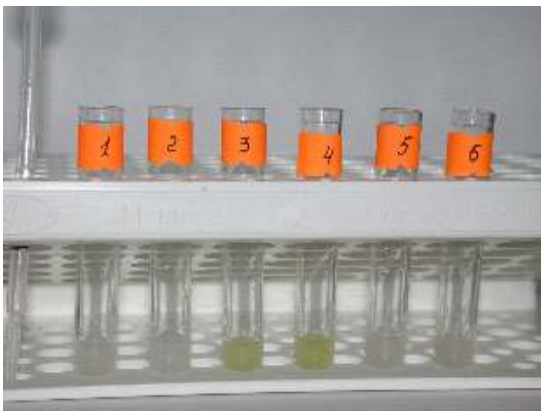
1.8.1. **A, D**





Determine the phases of culture growth in which genes C and D are expressed.



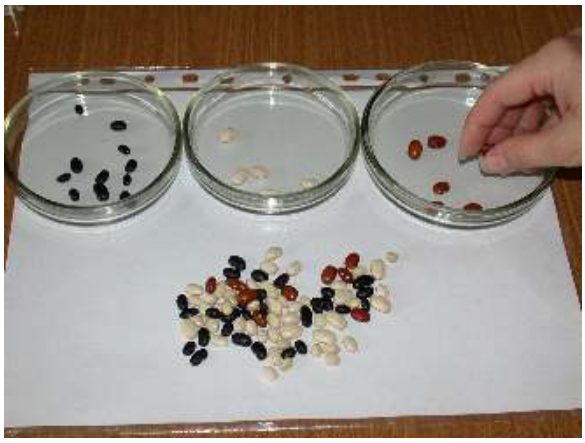


Task 2.

Strain	Gene	The gene is expressed in		
		early log phase	late log phase	stationary phase
I	C	+	–	–
II	D	–	–	+

4.2.4 Laboratory «GENETICS».







Determine if parental samples P_1 and P_2 are inbreed lines (homozygous by every pair of non-allelic genes).
Determine the type of inheritance of seed-coat color in common beans (presence of interaction of non-allelic genes A and B).
Determine the genotypes of the parental forms of P_1 and P_2, hybrid seeds F_1, seeds of F_a generation and analyzing line seeds L_a
Determine if the investigated non-allelic genes are linked.

Task 1.

1.1.1.

Plant seeds	Sample	Seed phenotype
		b
		w
		y

1.1.2.

A

1.2.1.

№ of class	Seed phenotype
1	w
2	b
3	y
Total	3

1.2.2.

D

1.3.1.

Plants	Seeds phenotype		
	Black	Yellow-brown	White
P_1	AAbb		
P_2			aaBB
F_1		AaBb	
L_a			aabb
F_a	Aabb	AaBb	aabb aaBb

1.4.1.

№ of class	Seeds phenotype	Number of seeds
1	w	54
2	b	39
3	y	15
Total of seeds		108

1.4.2.

1.4.3.

Phenotypic class	Ratio (%)
White seeds	50
Yellow-brown seeds	25
Black seeds	25

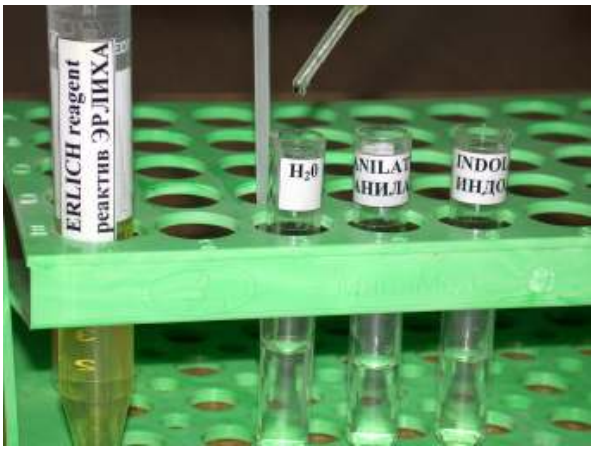
1.4.4.

Phenotypic class	Ratio (%)
White seeds	**50**
Yellow-brown seeds	**0**
Black seeds	**50**

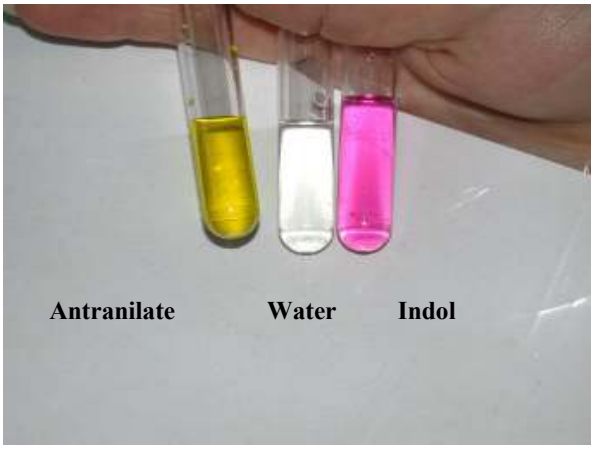
1.4.5. **1.4.6.** **1.4.7.**

10,67 **A, C** **F**





Identification of *trp* mutations in yeast *Saccharomyces cerevisiae*
Using a special pipette, add 0.5 ml of Erlich reagent to the control tubes with standard solutions of anthranilate, indole and to the tube with water (with no anthranilate and indole). Observe the colour change.



Task 2.

2.1.

Compound	Colour after Erlich reagent addition
Water	N
Anthranilate	Y
Indole	R
Colour code:	Y – yellow
	R – red
	N – no colour change

2.2.

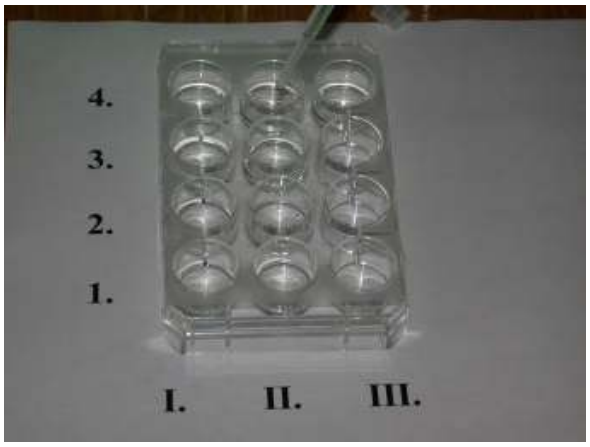
Mutant	
trp 2 $^{-}$	**O**
trp 4 $^{-}$	**A**
trp 5 $^{-}$	**I**
Code:	**A – anthranilate**
	I – indole
	O – neither antranilate nor indole

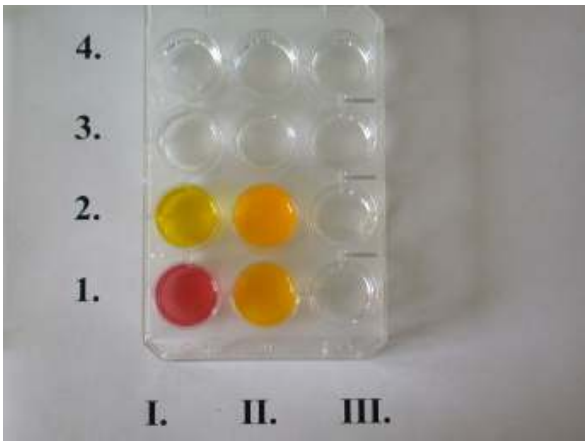
chorismate ⟶ anthranilate → → → indole →→ tryptophan

***trp2* gene** ***trp4* gene** ***trp5* gene**

2.3.

№	Mating	Possible progeny genotypes
№		
I	$trpX^{-}\ trpY^{-}\ trpZ^{+}$ × $trpX^{-}\ trpY^{+}\ trpZ^{-}$	$trpX^{-}\ trpY^{-}\ trpZ^{+}$
		$trpX^{-}\ trpY^{+}\ trpZ^{-}$
		$trpX^{-}\ trpY^{-}\ trpZ^{-}$
		$trpX^{-}\ trpY^{+}\ trpZ^{+}$
II	$trpX^{-}\ trpY^{-}\ trpZ^{+}$ × $trpX^{+}\ trpY^{-}\ trpZ^{-}$	$trpX^{-}\ trpY^{-}\ trpZ^{+}$
		$trpX^{+}\ trpY^{-}\ trpZ^{-}$
		$trpX^{-}\ trpY^{-}\ trpZ^{-}$
		$trpX^{+}\ trpY^{-}\ trpZ^{+}$
III	$trpX^{-}\ trpY^{+}\ trpZ^{-}$ × $trpX^{+}\ trpY^{-}\ trpZ^{-}$	$trpX^{-}\ trpY^{+}\ trpZ^{-}$
		$trpX^{+}\ trpY^{-}\ trpZ^{-}$
		$trpX^{-}\ trpY^{-}\ trpZ^{-}$





To test the accumulation of particular compounds, transfer 1 ml of liquid from each tube to the wells of the 12-well plate.
Add 0.5 ml of the Erlich reagent (using a special pipette) to each well with 1 ml of supernatant. Record the colour changes

2.4.

			Colour after Erlich reagent	
I	$trpX^- trpY^- trpZ^+$ × $trpX^- trpY^+ trpZ^-$	I.1	R	I
		I.2	Y	A
		I.3	N	O
		I.4	N	O
II	$trpX^- trpY^- trpZ^+$ × $trpX^+ trpY^- trpZ^-$	II.1	Y	A
		II.2	Y	A
		II.3	N	O
		II.4	N	O
III	$trpX^- trpY^+ trpZ^-$ × $trpX^+ trpY^- trpZ^-$	III.1	N	O
		III.2	N	O
		III.3	N	O
		III.4	N	O
Code:			У – yellow	A – anthranilate
			R – red	I – indole
			N – no colour change	O – neither antranilate or indole

2.5.

Gene	Mutation
trp 2	*trp Z* $^{-}$
trp 4	*trp Y* $^{-}$
trp 5	*trp X* $^{-}$

2.6.

A

2.7.

I _____2_____
II_____2_____
III_____2_____

2.8.

II

2.9.

trp5 $^{+}$ ***trp4*** $^{-}$ ***trp2*** $^{+}$

2.10.