Are flies homosexual?

Institut Joan Oró
Montse Irun & Yolanda Solé

Generació Plurilingüe (GEP)
Year 2
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Identification of the GEP project

Title	Are Flies Homosexual?
Authorship	Montse Irun and Yolanda Solé
School	Institut Joan Oró
Students' CEFR Level (A1, A2...)	B2+
Grade	1st Batxillerat – Year 11
Content area(s)	Biology
Number of sessions (4, 6 or 9)	9
Teacher(s) involved	Montse Irun & Yolanda Solé
Key words	Heritage – Mendel's laws – Qualitative and Quantitative features – Genetic Wheel

1. OUR PROJECT

Introduction:
This is a biology project carried out in Year 11 by a group of students who have a B2+ level as average. This project is related to the concept of heritage and students are presented a dilemma which they have to prove or reject by means of an experiment in the lab.

Driving question: Why are there homosexual flies?

Final product: Scientific poster to be used for an exhibition to year 10 students

2. GOALS	2. HOW DO YOU KNOW STUDENTS ARE MAKING PROGRESS? (assessment criteria)
1. 1. To apply the strategies of the scientific research and to design a scientific poster with problem approach, hypothesis formulation, search of information, elaboration of strategies of resolution, analysis and communication of results with explanatory and predictive capacity of the Compliance with the Laws of inheritance.	1.1. Show attitudes associated with scientific work, such as curiosity in the search for information, critical capacity, interest in verifying facts, questioning what seems obvious and open attitude to new ideas, as well such as teamwork and the application and communication of knowledge. 1.2. Design and carry out investigations applying the scientific work characteristics: problem approach, formulation of contrasting hypotheses, design and realization of experiences and analysis, discussion and communication of results.
2. 2. To justify and investigate the laws and the molecular and cellular mechanisms of inheritance and evaluate their ethical and social implications	2.1. Analyze and communicate in a scientific poster the molecular basis of the inheritance and the expression of genes and describe the mechanisms of transmission of

	hereditary characters in accordance with the inheritance model, applying it to solving problems inheritance linked to sex.

3. CURRICULUM CONNECTIONS
SPECIFIC COMPETENCES AND KEY CONTENTS

Subject-matter curriculum		Foreign language curriculum	
Specific Competences	**Key Contents**	**Specific Competences**	**Key Contents**
1. To apply the one-character heritage model and heritage solving problems. 2. To be able to explain the genic, chromosomal and genetic mutations. 3. To argue about ethical dilemmas and participating actively, listening or reading with attention, or giving opinions	1. Analysis of the relationship between genotype and phenotype and definition of the concept of gene. 2. Gathering of relevant information from different sources and in different formats, re writing it and using it in a problem or debate.	1 To participate in conversations and debates in class to exchange information, ideas and opinions and reach agreements 2. To explain concepts, experiments and their results fluently, both in written or spoken form.	1. Fluent argumentation of own ideas in debates or discussions in class. 2. Oral presentation of the results of an experiment by means of a scientific poster, where the relationship between cause and effect are established.

4. 21st CENTURY COMPETENCES

Collaboration	✓	Information, media and technology	✓

Communication	✓	Leadership & Responsibility	✓
Critical Thinking and Problem Solving	✓	Initiative & Self-direction	✓
Creativity & Innovation	✓	Social & Cross-cultural	✓
Others:			

5. KEY COMPETENCES			
Communicative, linguistic and audiovisual competence	✓	Digital competence	✓
Mathematical competence		Social and civic competence	
Interaction with the physical world competence	✓	Learning to learn competence	✓
Cultural & artistic competence		Personal initiative and entrepreneurship competence	

6. CONTENT (Knowledge and Skills)

CONTENT-RELATED KNOWLEDGE	CONTENT-RELATED SKILLS
1. Application of the one-character heritage model and heritage solving problems. 2. Signification of the genic, chromosomal and genetic mutations.	3.Arguing about ethical dilemmas and participating actively, listening or reading with attention, giving opinions.

7. REFERENCES

Coriell Institute for Medical Research. Pedigree Symbol Definitions. 1998
http://depts.washington.edu/cberglab/wordpress/outreach/an-introduction-to-fruit-flies/
http://www.genetics.org/content/201/3/815

8. COMMENTS (optional)

The unit is carried out in a group of highly motivated students whose English level is between B2 and C1. They are used to working in teams and PBL.

9. ACKNOWLEDGEMENTS (optional)

Skills: R: reading , S:speaking, L: listening, W: writing, I: Interaction
Interaction: T-S: teacher-student, S-S: student-student, SG: small groups, WG: whole group, S-Expert, S-World
Assessment: PA: Peer assessment, SA: Self-assessment, TA: Teacher assessment, AT: Assessment tools

10. UNIT OVERVIEW

Session	Activities	Timing 	Skills 	Interaction 	ICT 	Assessment 
1	Introducing PBL. Guiding question	25	S	Whole class	Answergarden	questionnaire
	Initial assessment	10	S	Individual-pair-group		KWL Chart as initial evaluation Checklist as a benchmark
	Debate	25	I	Groups		

2	Mendel's Law. Expert groups	30	R S W	Groups		
	Genetic concept	30	R W	Individual pair		
3	Qualitative quantitative	30	I	Group		Self assessment questionaire
	Blood types	15	L I	Individual Pair Group		
	Genetic Wheel	15	R	Individual		
4	Drosophila life cycle	20	R S	Group	Web sites	
	Lab sexing	20	S	Group		
	Matting	5	S	Group		
	Lab report Beginning	15	W	Individual		
5	Pedigree symbols	10	R	Pairs		
	Design your pedigree	30	W	Individual	Webpage	Socrative or quizziz for assessment of contents.

	Result Analysis	20	I	Group		
	Lab report ending	HW	W	Individual	Moodle ®	Peer assessment with gallery walk and a praise, a question and a polish
6	Think of the experiment to prove they are homosexual	45	I R	Group	Moodle®	
	Base d'orientació	15	I	Whole Class		Base de orientació before designing the scientific poster.
7	Group work: Poster	60	I W	Group		
8	Group work: Poster	60	I W	Group	Padlet	Peer assessment and self assessment of poster.
9	Feedback 4th ESO lecture	60	S	Group	Portfolio (personal website)	Checklist to self- peer- and teacher assessment of the exhibition

11. SESSION PLANNING
(See the guidelines in the teacher's handout for more detailed instructions)

	SESSION 1: Beginning the project Objectives of the session: To assess students' point of departure To motivate students to research a heritage question					
	Content-obligatory language for the session: nature, nurture, language for debates.					
	Activities					
1.1	Photograph description using TIC tool Show students this photograph on the screen. What is it? A fly. What is its scientific name? Drosophila What do they know about them? Tell students to answer this question on https://answergarden.ch/863964 If you do not have access to mobile phones, write the information on the screen. Do not correct any wrong information.	5	S	C	*yes*	yes
1.2	Watching a video to present guiding question Tell students to watch the video and to pay attention to the question it poses. After the video, ask students to write down the questions the video leaves unanswered. Are any of these questions interesting to investigate? Suggest "Are flies homosexual?" Tell students the aim of the unit is to learn about heritage. Ask students what they need to study if they are to learn about heritage: Mendel's laws, cells, pedigree, etc. When this is clear, students can be given the handout.	10	I	C		
1.3	Initial evaluation "heritage" Ask students to write down everything they know about heritage. Give them an example to help them "In eye colour, the gene for brown is dominant to that of blue eyes". Give them 3 minutes. Then ask them to complete the other two columns. They can write their ideas in the language they want since the aim of the activity is to make them aware of what they know and would like to learn	3	W	I		

1.4	Debate: Nature or Nurture Distribute the cards in each group. They have three minutes to discuss about each picture on the ppp. The aim is to get rid of all their cards. The student with less cards is the winner. Give them one point per photo. If the instructions are too difficult to understand, do it yourself as an example.	25	I	G		

	SESSION 2: Mendel's Laws and Genetic concepts Objectives of the session: To review the 3 Laws and to apply them in a problem. To revise terms related to heritage					
	Content-obligatory language for the session: All those included in the matching.					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					
1.1	Mendel's Laws: Expert groups Ask students if they remember Mendel's laws. Then, ask them how many they are and their names. Make three groups. Tell them that each group is going to read a different text. (The texts are on the next three pages.) They have to remember the information in the text and that they can help each other. While they are reading the texts, go over the groups and give each student a different number in each group. The aim is that there are three students with number 1, three with number 2, and so on. Once they are done (about 10 minutes), collect the papers and ask students to meet with the students with their same number. This time there will be groups of three students, each one having read a different text.	30	R S W	G		

1.2	Matching genetic terms Students match the terms and their definitions	15	R W	I P		
1.3	Crossword Students complete a crossword with the words learnt in the previous activity	15	R W	I P		

	SESSION 3: Qualitative and quantitative traits Objectives of the session: To distinguish between qualitative and qualitative traits To design a pedigree on their family blood types					
	Content-obligatory language for the session: Blood types, qualitative traits, quantitative traits.					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					
3.1	Collecting information about qualitative and quantitative traits about each student. Explain to students that they will investigate human uniqueness and variability by collecting data about six different human characteristics. Tell them to follow the instructions in their worksheet. Give them 15 minutes to collect the data. Go around the classroom helping students and giving suggestions	15	I	G		
3.2	Gather the information as a group and as a class.	5	I	G		

3.3	Design of a bar graph for one trait for the whole class Finally, give them about 15 minutes to design the graph. As there are 5 groups, give one trait to each group. Display the charts in the classroom.	10	I	G		
3.4	Video watching and answering questions to check knowledge Tell the class that now they have to reflect on the results of the investigation. In order to get a conclusion, they have to discuss the questions that follow in their groups.	10	R	I	*y*	*s*
3.5	Video watching and completion of a chart Some students think everything is inherited, some think very few traits are inherited, and others will say that it depends on the trait. The goal is to get them to think about the question and for you to find out what they think, rather than for them to learn about each trait at this point in the course. The individual's environment and/or experience are factors that may affect a trait. For example, freckles are an example of a trait with genetic and environmental factors. Although a tendency to get freckles is inherited, exposure to the sunlight will greatly affect the degree to which an individual develops freckles. This is just one example; students are likely to come up with many others.	HW	L	G		
3.6	Answering questions on blood types Students answer some questions on a text	15	R W	G		
3.7	Design of a pedigree on their family blood types Students design a pedigree on their family blood types at home for homework	HW	W	I		
3.8	Genetic Wheel Tell students to read the instructions and follow them. Once they have the wheel completed, ask them to place them on the wall so that they all realize that there are no two exact wheels. That is a proof of genetic variation in our class.	15	R	I		

	SESSION 4: Drosophila Life Cycle Objectives of the session: To read about the *Drosophila* life cycle To sex and mate *Drosophila*					
	Content-obligatory language for the session: Mating, sexing, larvae					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					
4.1	Research the classification of the *Drosophila* Tell students that they are going to learn about the fly and its life cycle and that they are going to sex and mate some flies. First, they have to look for the information on the web and later, they have to complete the information but walking around the classroom and getting the information from the information posters on the walls. They do both activities in groups.	10	R	G		
4.2	Read and answer some questions on the *Drosophila life cycle* *Students read and answer questions on posters hanged on the walls*	10	R S	G		
4.3	Lab sexing Students follow the instructions in order to sex the flies	20	S	G		
4.4	Mating Students follow the instructions in order to mate the flies	5	S	G		
4.5	Lab report beginning Students start writing their lab report	15	W	I		

	SESSION 5: Pedigrees Objectives of the session: To design the pedigree					
	Content-obligatory language for the session: Pedigree and related words					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					
5.1	Matching symbols and names Students match symbols and names	10	R	P		
5.2	Solving a problem on pedigrees Students are given some problems and they have to find the solutions in their groups	5	R	I		
5.3	Design your pedigree Students design their pedigree	30	W	I	*y*	
5.4	Result Analysis Students analyse their results	20	I	G		
5.5	Lab report ending Students finish their lab report	HW	W	I	*y*	*y*

	SESSION 6: Experiment Objectives of the session: To design an experiment to prove whether Drosophila are or are not homosexual					
	Content-obligatory language for the session:					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					
6.1	Think of the experiment to prove they are homosexual In groups, students start thinking of an experiment to prove or refute their hypothesis	45	I R	G	*y*	
6.2	*Base d'orientació* Students write a base d'orientació together in class.	15	I	c		*y*2

	SESSION 7: Poster design Objectives of the session: To design a scientific poster on the students' experiment

	Content-obligatory language for the session: Students' choice					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					
7.1	Poster Design Students design their poster	45	I W	G		
7.2	Peer assessment on poster design Students assess their peers.	15	I	G	*y*	*y*

	SESSION 8: Poster design Objectives of the session: To design a scientific poster on the students' experiment					
	Content-obligatory language for the session: Students' choice					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					

8.1	Poster Design Students improve their poster based on the feedback received.	45	I W	G		

	SESSION 9: Presentation of the findings to 4th ESO students Objectives of the session: To present the findings of the students' experiment by means of a scientific poster					
	Content-obligatory language for the session: Students' choice					
	Activities *include : Name and description; Assessment tool (if any); Material (including language support)*					
9.1	Presentation to 4th ESO students Students present their findings to the 4th ESO students	60	S	G		
9.2	Peer, self and teacher's assessment Students assess themselves, their peers and finally the teachers assess their work.				*y*	*y*

Are flies homosexual?

Show students this photograph on the screen. What is it? A fly. What is its scientific name? Drosophila What do they know about them? Tell students to answer this question on https://answergarden.ch/863964 If you do not have access to mobile phones, write the information on the screen. Do not correct any wrong information.

Tell students to watch the video and to pay attention to the question it poses. After the video, ask students to write down the questions the video leaves unanswered. Are any of these questions interesting to investigate? Suggest "Are flies homosexual?"

Tell students the aim of the unit is to learn about heritage. Ask students what they need to study if they are to learn about heritage: Mendel's laws, cells, pedigree, etc. When this is clear, students can be given the handout.

At the end of this learning unit, we would be able to

a) justify and search whether the three Mendel's laws work by means of a heritage character.
b) evaluate whether flies may be homosexual because of heritage or because of nurture
c) apply strategies of scientific investigation and design a scientific poster to present the investigation.

I.- How much do you know about heritage?

Ask students to write down everything they know about heritage. Give them an example to help them "In eye colour, the gene for brown is dominant to that of blue eyes". Give them 3 minutes. Then ask them to

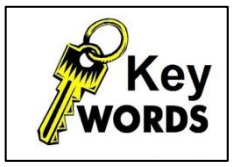
complete the other two columns. They can write their ideas in the language they want since the aim of the activity is to make them aware of what they know and would like to learn.

Fill in the chart.

What do you know about heritage?	What aren't you sure of?	What would you like to learn about heritage?

You should not correct it since it is only at the end of the unit that we will go back to this chart and check what they will have learnt by then.

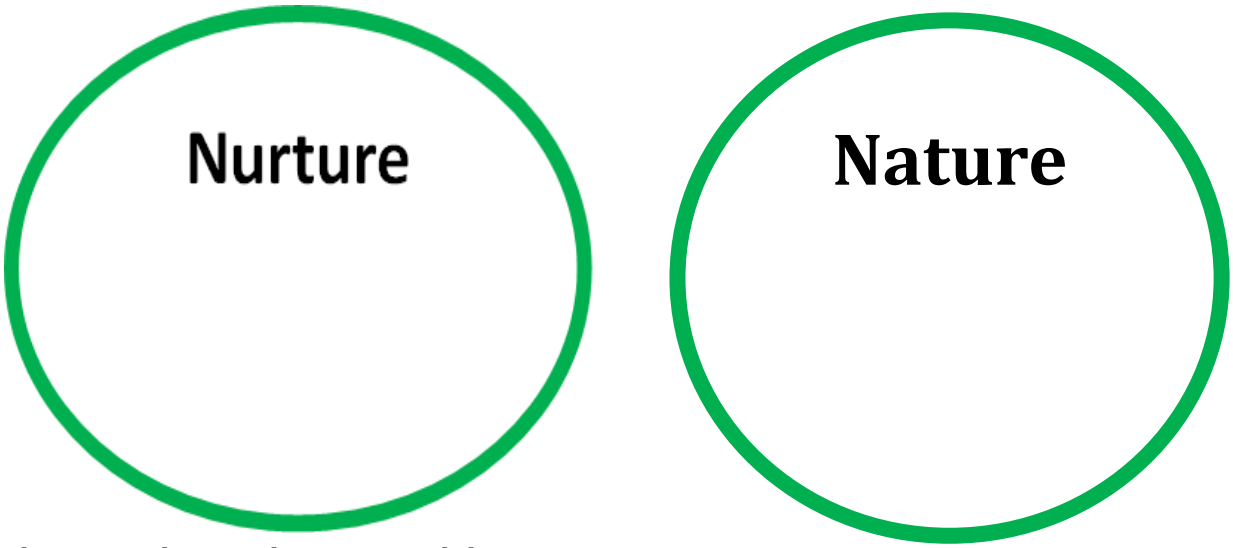
II.- Nature or Nurture?



nurture	n_____	_____
genes	g_____	_____
to pass through	p_____	_____

Like all living things, people have inherited innate qualities. There are also events or experiences which happen during life. 'Nature' describes the effect of a person's genes, whereas 'nurture' describes whatever happens during life.

Think-Pair-Share Think about YOUR characteristics and decide whether they have been impacted by nature or nurture.



Share it with your classmate and then to your group.

Debate You will be shown different statements. Discuss them in your group for 3 minutes. During the discussion, use as many expressions as possible. Each time you

use an expression, throw the card on the table. The first person to get rid of his or her cards is the winner.

Distribute the cards in each group. They have three minutes to discuss about each picture on the ppp. The aim is to get rid of all their cards. The student with less cards is the winner. Give them one point per photo. If the instructions are too difficult to understand, do it yourself as an example.

CARDS FOR THE DEBATE

The thing is ...	Actually, ...	The point I'm trying to make is ...	I see what you mean but ...	What I don't understand is ...
Well, yes, but to me ...	I can't agree with you there but ...	I really think ...	Yes, but ...	If you ask me, ...
To be honest, ...	The problem is ...	I really think ...	Strangely enough, ...	In fact, ...
I see your point but ...	Well, I agree but ...	The worst thing is ...	On the whole ...	Basically, ...
I couldn't agree with you more.	I'd say the exact opposite.	That's so true.	I couldn't agree with you more.	Imagine ...

III.- Mendel's Laws

Ask students if they remember Mendel's laws. Then, ask them how many they are and their names. Make three groups. Tell them that each group is going to read a different text. (The texts are on the next three pages.) They have to remember the information in the text and that they can help each other.

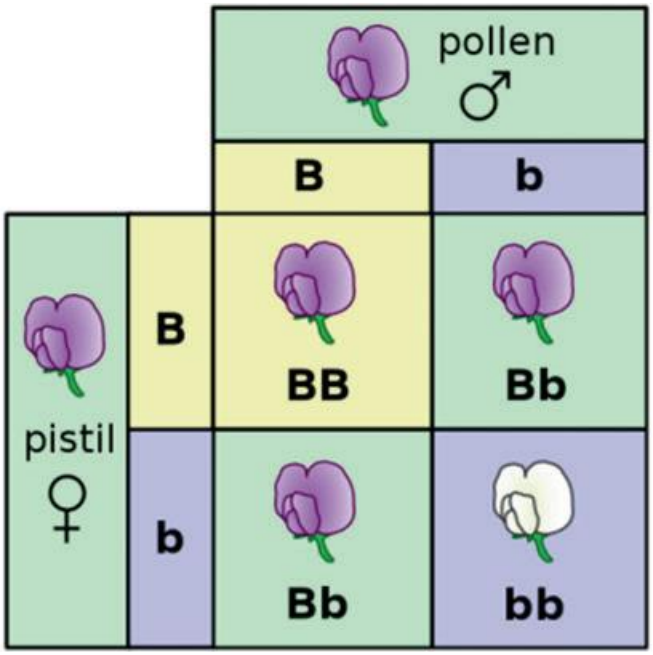
While they are reading the texts, go over the groups and give each student a different number in each group. The aim is that there are three students with number 1, three with number 2, and so on.

Once they are done (about 10 minutes), collect the papers and ask students to meet with the students with their same number. This time there will be groups of three students, each one having read a different text.

First Law: Law of Dominance

When individuals with one or more sets of contrasting characters (now known as **phenotypes**) are crossed, then the characters that appear in F1 generation are called **dominant characters**, and the characters that remain hidden are called **recessive characters**. For example, imagine that generation plants were crossed together and only purple-colored flower F1 generations were obtained. This shows that the dominant purple flower allele (B) will hide the phenotypic effects of the recessive white flower allele (b). This is known as the law of dominance.

White phenotypes will appear only in the absence of dominant purple flower alleles. The uppercase letters are used to denote dominant alleles, whereas the lowercase letters are used to denote recessive alleles. Mendel used the term "**factors**" instead of alleles during that time.

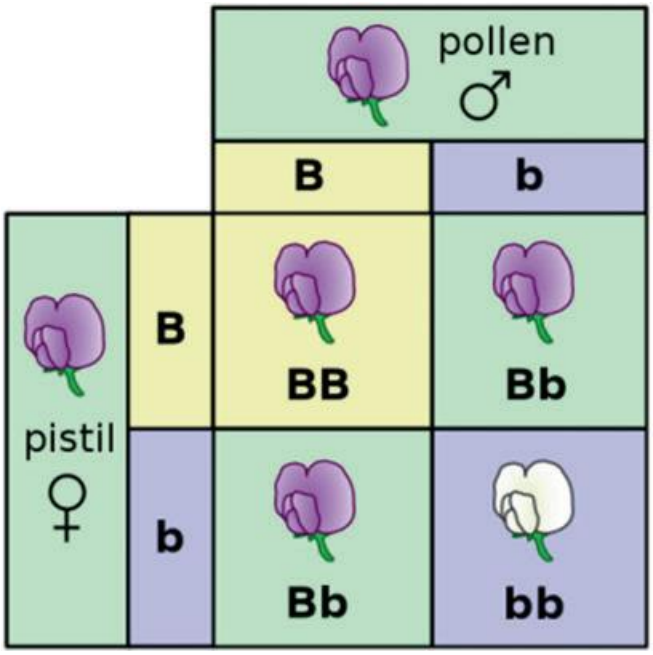


Mendel's Laws, Fig. 1 Punnett square describing self-fertilization of F1 pea plants (both purple). Here B and b represent the factors (now known as alleles). (Image credit: Madeleine Price Ball, CC0 licensed)

Second Law: Law of segregation

This law is also referred to as law of purity of gametes. During the formation of **male and female gametes** (generally sperm and ova in animals or pollen grains and ovule in plants), factors (**alleles**) responsible for a particular character separate and are passed into different gametes. This process implies that the gametes are either pure for dominant alleles or for recessive. These gametes can unite randomly in different possible combinations during fertilization and produce the genotype for the traits of the progenies. In a zygote, the two members of an allele pair remain together without being contaminated. This is known as law of segregation.

In Fig. 1, both pollen and pistil form male and female gametes, respectively, with either B or b allele. These male and female gametes combine randomly during fertilization to produce F1 generation of purple flower and white flower plants in the ratio of 3:1.

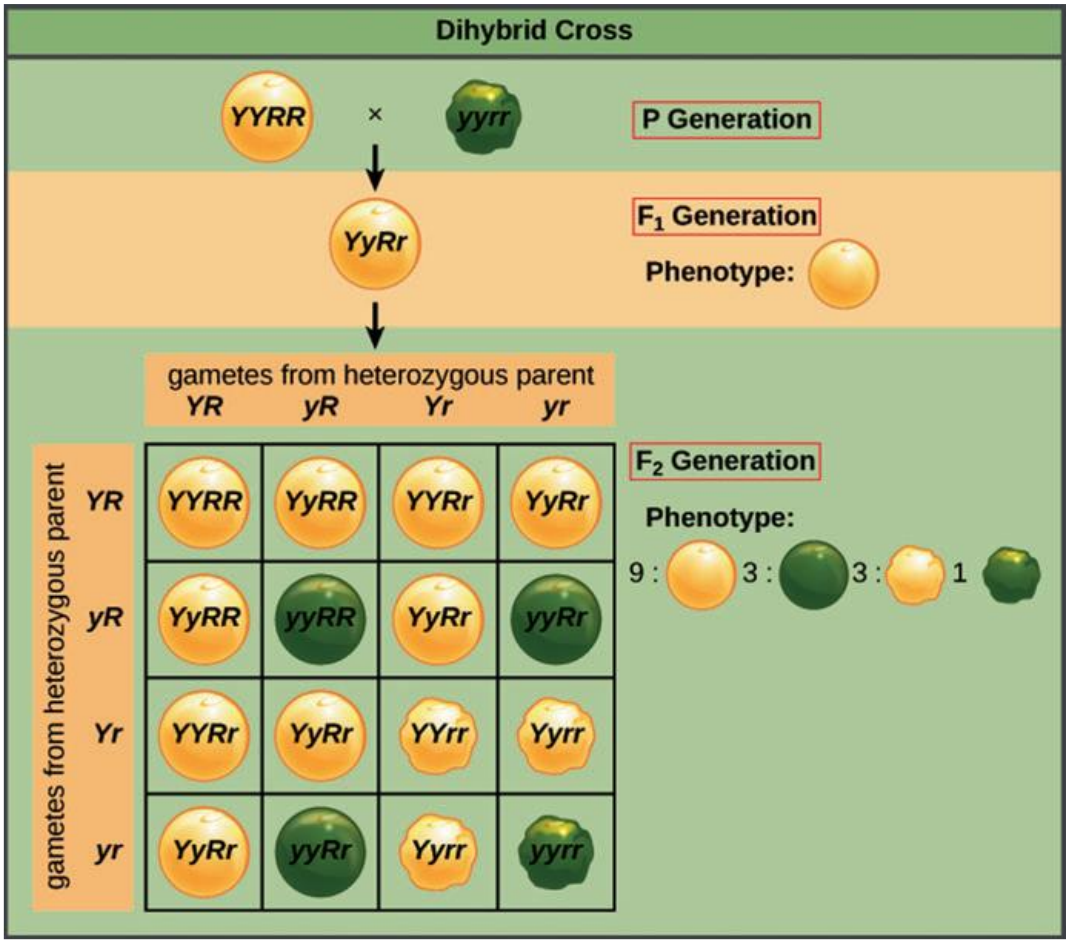


Mendel's Laws, Fig. 1 Punnett square describing selffertilization of F1 pea plants (both purple). Here B and b represent the factors (now known as alleles). (Image credit: Madeleine Price Ball, CC0 licensed)

Third Law: Law of Independent Assortment

This law is also known as inheritance law and is defined as **alleles** of different genes which distribute independently of one another during **gamete formation.**

Mixing a single trait (**monohybrid cross**) in Mendel's experiment constantly resulted in a 3:1 ratio between **dominant and recessive phenotypes**. However, when he performed experiments on two traits (**dihybrid cross**), he obtained F2 generation in the ratio of 9:3:3:1 (Fig. 2). These results led Mendel to conclude that different traits (e.g., seed shape and color) are inherited independently of one another and there is no relation between two traits.



Mendel's Laws, Fig. 2 Dihybrid cross between yellow round seed plant and green wrinkled seed plant. Here, Y (yellow) R (round) is the dominant allele over y (green) r (wrinkled). (Image credit: https://opentextbc.ca/biology/chapter/8-2-laws-of-inheritance/ CC license)

Tell them to explain what they have learnt to the other two students who have to pay attention as they will need the information later on. Make sure, students do not write anything down.

Once they are done (15 minutes), ask them to go back to their previous groups and ask them to complete the table in their handout in groups. The table is a summary of the three laws.

Read your text individually. Then, join the students with your same text and check you all understand the ideas there. Pay especial attention to the words in bolds. They are important. Practice your summary in your group.

Then **join two students with a different text and explain the law to them.** When you are done, go back to your group and fill in this chart to prove that you understand the three laws.

	First Law: Law of Dominance	Second law: Law of Segregation	Third Law: Law of Independent Assortment
Explanation			
Drawing			

Example			

Remind students that frames are helpful scaffolding for writing.

IV.- Genetic Concepts

Tip: Start with the ones you already know for sure. Leave till the end they ones you are not sure of.

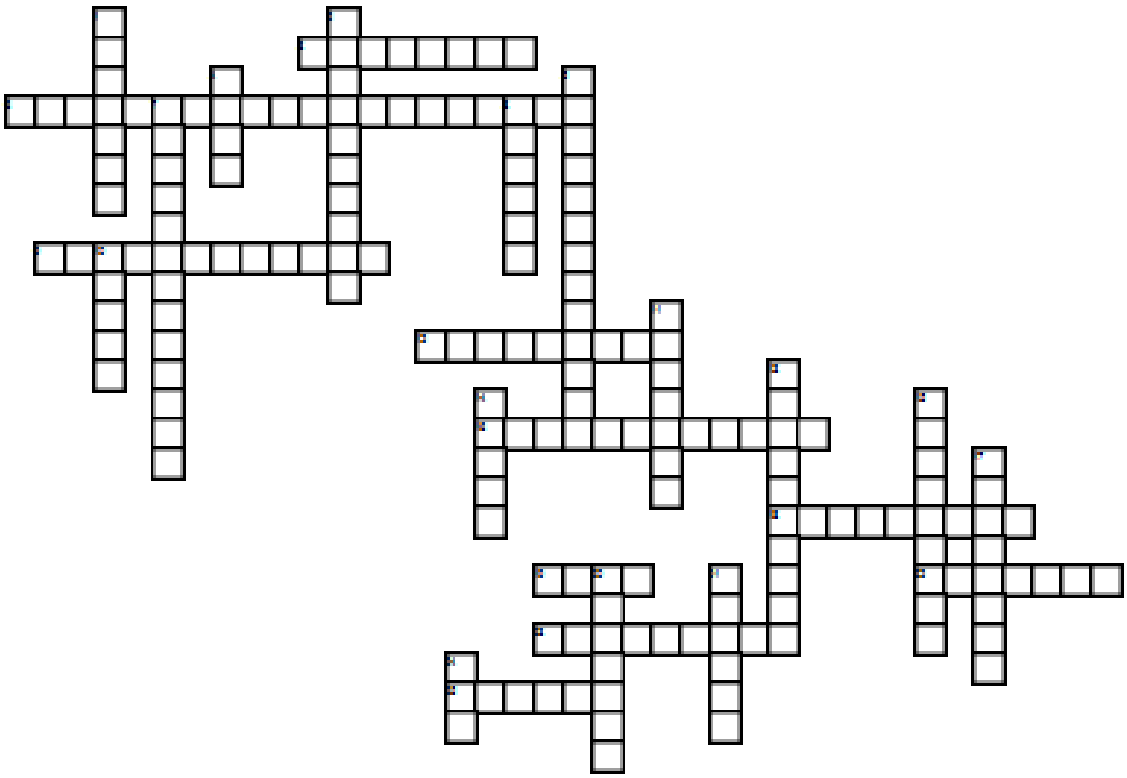
Match the concepts and the definitions in pairs.

CHIASM	The site at which two homologous chromosomes make contact (thus appearing to be crossed), enabling the exchange of genetic material during the prophase stage of meiosis.
FERTILIZATION	the action or process of fertilizing an egg, female animal, or plant, involving the fusion of male and female gametes to form a zygote.
PHENOTYPE	The observable characteristics, at the physical, morphologic, or biochemical level, of an individual, as determined by the genotype and environment.
GENOTYPE	Individual's collection of genes.
PEDIGREE CHART	Diagram that shows the occurrence and appearance or phenotypes of a particular gene or organism and its ancestors from one generation to the next.
HETEROZYGOUS	Having different alleles at a given locus on the pair of chromosomes present in the diploid state.
HOMOZYGOUS	Having identical alleles at one or more loci.
HOMOLOG	A gene similar in structure and evolutionary origin to a gene in another species.
PUNNET SQUARE	diagram that is used to predict an outcome of a particular cross or breeding experiment.
INCOMPLETE DOMINANACE	genetic situation in which one allele does not completely dominate another allele, and therefore results in a new phenotype.

OFFSPRING	The organism or organisms resulting from sexual or asexual reproduction.
SPERM	A male gamete, such as a spermatozoon of an animal or one of the cells or nuclei produced by a pollen grain of a plant.
ALLELE	One of two or more alternative forms of a gene at the same site in a chromosome, which determine alternative characers in inheritance.
CHROMOSOME	Structure in the nucleus, containing a linear thread of DNA, which transmits genetic information and is associated with RNA and Histones.
EGG	A female reproductive cell at any stage before fertilization; after fertilization and fusion of the pronuclei it is called a zygote.
GAMETE	One of two haploid reproductive cells, male and female, whose union is necessary in sexual reproduction to initiate the development of a new individual.
GENE	One of the biologic units of heredity, self-reproducing, and located at a definite position (locus) on a particular chromosome.
CELL	The smallest structural and functional unit of an organism, typically microscopic and consisting of cytoplasm and a nucleus enclosed in a membrane.
RECESSIVE	denoting heritable characteristics controlled by genes that are expressed in offspring only when inherited from both parents.
DOMINANT	Form of a gene overpowers the counterpart, or recessive, form located on the other of a pair of chromosomes.
CENTROMER	The point on a chromosome by which it is attached to a spindle fiber during cell division.
MITOSIS	A type of cell division that results in two daughter cells each having the same number and kind of chromosomes as the parent nucleus, typical of ordinary tissue growth.
MEIOSIS	The process of cell division by which reproductive cells (gametes) are formed.
TRAIT	A distinguishing quality or characteristic, typically one belonging to a person.
NUCLEUS	A spheroid body within a cell, contained in a double membrane, the nuclear envelope, and containing the CHROMOSOMES and one or more nucleoli.

Complete the crossword in pairs

Genetic Concepts



ACROSS

3 Form of a gene overpowers the counterpart, or recessive, form located on the other of a pair of chromosomes.

6 a genetic situation in which one allele does not completely dominate another allele, and therefore results in a new phenotype.

9 Having different alleles at a given locus on the pair of chromosomes present in the diploid state.

12 The observable characteristics, at the physical, morphologic, or biochemical level, of an individual, as determined by the genotype and environment.

16 diagram that is used to predict an outcome of a particular cross or breeding experiment.

18 The organism or organisms resulting from sexual or asexual reproduction.

19 One of the biologic units of heredity, self-reproducing, and located at a definite position (locus) on a particular chromosome.

22 A type of cell division that results in two daughter cells each having the same number and kind of chromosomes as the parent nucleus, typical of ordinary tissue growth.

23 denoting heritable characteristics controlled by genes that are expressed in offspring only when inherited from both parents.

25 One of two haploid reproductive cells, male and female, whose union is necessary in sexual reproduction to initiate the development of a new individual.

DOWN

1 A gene similar in structure and evolutionary origin to a gene in another species. 2 Having identical alleles at one or more loci.

4 The smallest structural and functional unit of an organism, typically microscopic and consisting of cytoplasm and a nucleus enclosed in a membrane.

5 the action or process of fertilizing an egg, female animal, or plant, involving the fusion of male and female gametes to form a zygote.

7 Diagram that shows the occurrence and appearance or phenotypes of a particular gene or organism and its ancestors from one generation to the next. 8 One of two or more alternative forms of a gene at the same site in a chromosome, which determine alternative characters in inheritance.

10 A distinguishing quality or characteristic, typically one belonging to a person.

11 The process of cell division by which reproductive cells (gametes) are formed.

13 Structure in the nucleus, containing a linear thread of DNA, which transmits genetic information and is associated with RNA and Histones.

14 A male gamete, such as a spermatozoon of an animal or one of the cells or nuclei produced by a pollen grain of a plant.

15 The point on a chromosome by which it is attached to a spindle fiber during cell division.

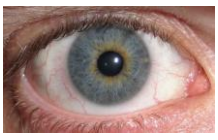
17 Individual's collection of genes.

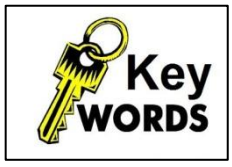
20 A spheroid body within a cell, contained in a double membrane, the nuclear envelope, and containing the chromosomes and one or more nucleoli.

21 The site at which two homologous chromosomes make contact (thus appearing to be crossed), enabling the exchange of genetic material during the prophase stage of meiosis.

24 A female reproductive cell at any stage before fertilization; after fertilization and fusion of the pronuclei it is called a zygote.

VI.- Qualitative & quantitative traits





trait	t_____	_____
genes	_____	_____
to round	r_____	_____

Explain to students that they will investigate human uniqueness and variability by collecting data about six different human characteristics. Tell them to follow the instructions in their worksheet. Give them 15 minutes to collect the data. Go around the classroom helping students and giving suggestions

You are going to investigate qualitative and quantitative traits by collecting information about you. **Record the results on the table that follows**. Write the names of the members of your group and

a.- What colour are each person's eyes: blue, gray, green, brown, or hazel (hazel eyes are a very light brown with yellow or green tones)?

b.- Who can roll his/her own tongue into a U-shape?

c.- Who can cross all the fingers of the hand he or she normally writes? You may use your other hand to help position the fingers. You should begin by crossing your pointer finger over your thumb, then try to cross your middle finger over your pointer finger. Continue trying to cross each finger, one by one, on top of the next finger.

d.-Measure each other's height in centimeters (cm). Round to the nearest 5 cm and record the results on the student sheet in centimeters (cm).

e.- Obtain the arm span by spreading your arms out sideways as far as possible, and having your partner measure from the tips of the fingers on one hand to the tips of the fingers on the other hand. Round to the nearest 5 cm and record the results on the student sheet.

Trait	Name:	Name:	Name:	Name:	Group Totals
Eye Color:					
blue					
brown					
gray					
green					
hazel					
Tongue Rolling:					
yes					
no					
Finger Crossing:					
yes					
no					

Height (in cm)					
Arm span (in cm)					

Tell each group to choose a person to report their finding to the other groups and another person has to collect the results from the other groups in the chart.
Have one person report your group's results to the other groups.

Have one person in your group collect the results from the other groups. Record the class totals on the following chart.

Trait	Group 1	Group 2	Group 3	Group 4	Group 5	Class Totals
Eye Color:						
blue						
brown						
gray						
green						
hazel						
Tongue Rolling:						
yes						
no						
Finger Crossing:						
yes						
no						
Height (in cm)						
cm						
cm						
cm						
cm						
cm						
cm						
cm						
Armspan (in cm)						
cm						
cm						

cm						
cm						
cm						
cm						

Finally, give them about 15 minutes to design the graph. As there are 5 groups, give one trait to each group. Display the charts in the classroom.

Prepare a bar graph of the class data of one of the traits, as assigned by your teacher. Be sure to label your axes and title your graph.

Think about it in your group

Tell the class that now they have to reflect on the results of the investigation. In order to get a conclusion, they have to discuss the questions that follow in their groups.

For each of the six characteristics you studied, how many versions, or traits, are observed in your class? For example, if your class has people with brown and blue eyes only, then you would fill the first row in the second column with "brown and blue," and the third column with the number "2" to represent the two colours observed.

Characteristic	Traits	Number of Traits
eye colour	brown, blue, green, gray, hazel	5 (fewer if class does not have all alternatives)
tongue-rolling	Yes, No (There may be a few hard to classify.)	2
finger-crossing	Yes, No (There may be a few hard to classify.)	2
height	many	variable, up to # of students in class
arm span	many	variable, up to # of students in class

Which of the traits you investigated—for eye color, tongue rolling, crossing all your fingers, height, and arm span—do you think people inherit from their biological parents? Explain.

Some students think everything is inherited, some think very few traits are

inherited, and others will say that it depends on the trait. The goal is to get them to think about the question and for you to find out what they think, rather than for them to learn about each trait at this point in the course. The individual's environment and/or experience are factors that may affect a trait. For example, freckles are an example of a trait with genetic and environmental factors. Although a tendency to get freckles is inherited, exposure to the sunlight will greatly affect the degree to which an individual develops freckles. This is just one example; students are likely to come up with many others.

Now, watch this video and answer the questions to sum up this section.

CHECK WHAT YOU HAVE LEARNT SO FAR

Tick the boxes that show what you know

	YES	QUITE	NOT SURE	NO
The difference between nurture and nature				
Mendel's laws				
Recessive and dominant phenotypes				
Monohybrid and dihybrid cross				
Qualitative and quantitative traits				

The thing I remember the most in this unit is

_____
_____
_____

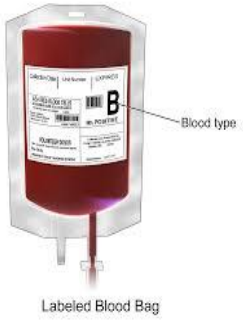
Remind students to revise the aspects they have not learnt and encourage them to improve.

VI.- Blood types

Ask students what they know about blood types. Write their ideas on the board. Ask them to watch the video and complete the chart that follows.

Watch the video on Moodle ® and fill in the chart:

Donor Blood Type	Acceptor Blood Type
Type A	Type A, Type AB
Type B	Type B, Type AB
Type AB	Type AB
Type 0	All types



Labeled Blood Bag

Correct the chart with this short video.

Ask students to solve the problems posed in pairs. Then ask them to correct them in their groups and finally check with the whole class.

Blood Type Problems:

1. List all the possible genotypes for each of the 4 blood types:
   - Type O _____
   - Type A _____
   - Type B _____
   - Type AB _____

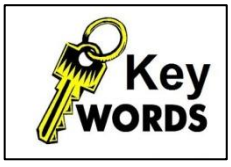
2. A woman with AB blood is married to a man with AB blood. What blood types will their children be and in what proportion?

3. A woman with type AB blood is married to a man with type O blood. They have two natural children, and one adopted child. The children's blood types are: A, B, and O. Which child was adopted?

4. A woman of unknown genotype has type B blood, her husband has type A blood (also unknown genotype). List **ALL** the blood types possible for their children.

Tell students to design the pedigree for their family blood type for homework.

VII.- Genetic Wheel



dimples	d_____	_____
pinkies	p_____	_____
widows peak	w_____	_____

Tell students to read the instructions and follow them. Once they have the wheel completed, ask them to place them on the wall so that they all realize that there are no two exact wheels. That is a proof of genetic variation in our class.

The following are considered to be single gene traits. **Find out if your traits are dominant or recessive and plot them on the genetic wheel to see genetic variation within your class.**

Laugh dimples
ll no dimples (homozygous recessive)
L dimples (heterozygous or homozygous dominant)

Tongue roll
tt can't roll tongue into "U" shape (homozygous recessive)
T can roll tongue into "U" shape (heterozygous or homozygous dominant)

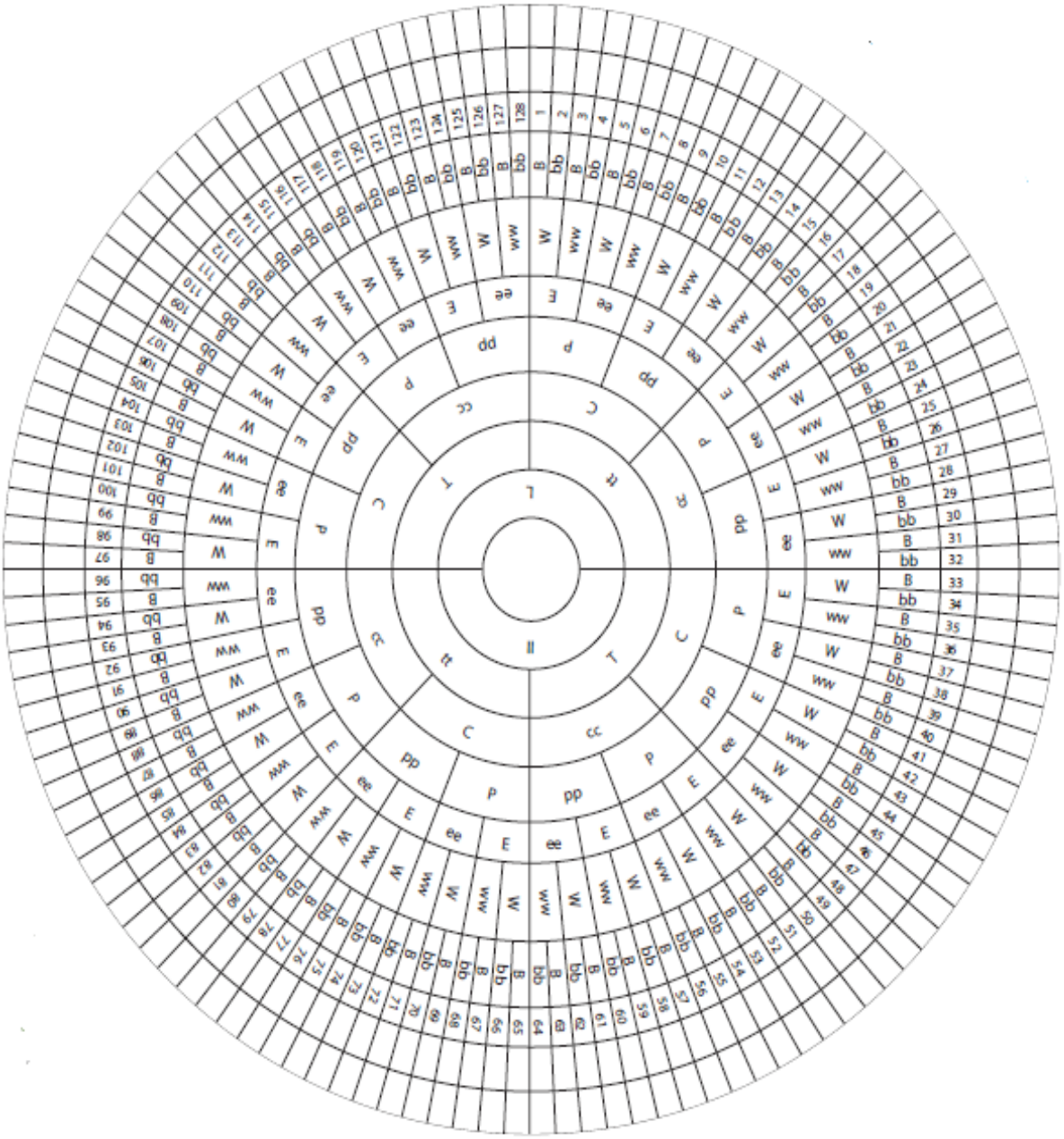
Crossing Thumbs
cc right thumb on top of clasped hands (homozygous recessive)
C left thumb on top of clasped hands (heterozygous or homozygous dominant)

Pinkies
pp pinkies are straight when pressed side by side (homozygous recessive)
P pinkies bend away from each other, toward the ring fingers, when pressed side by side (heterozygous or homozygous dominant)

Ear lobes
ee attached ear lobe (homozygous recessive)
E free ear lobe (heterozygous or homozygous dominant)

Widow's peak
ww no widow's peak (homozygous recessive)
W has a widow's peak (heterozygous or homozygous dominant)

Bending thumbs (Hitch-hiker's thumb)
bb thumb bends at 90 degree angle (homozygous recessive) B thumb is straight (heterozygous or homozygous dominant)



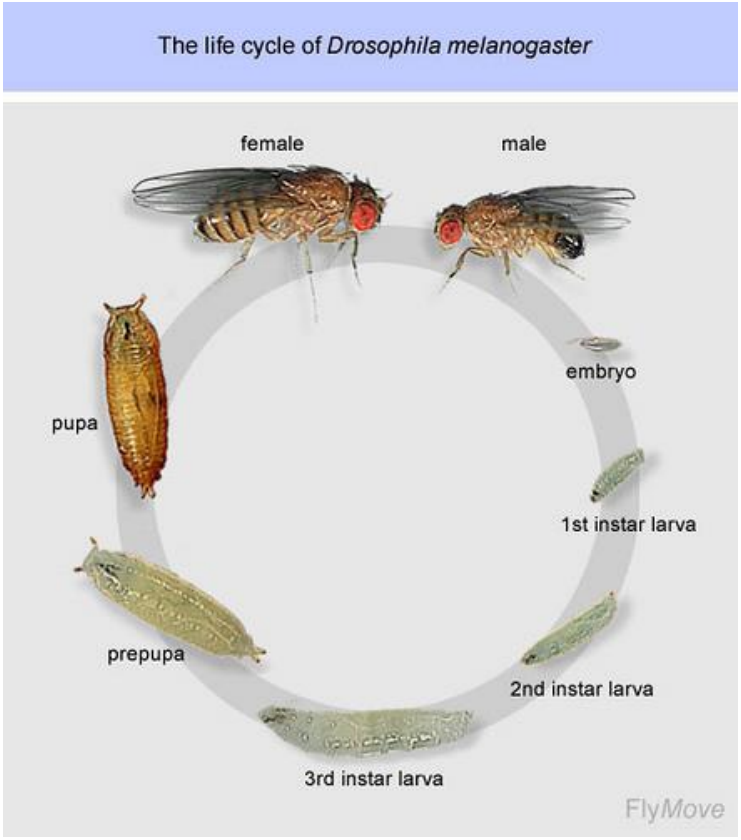
VIII.- Drosophila life cycle

Tell students that they are going to learn about the fly and its life cycle and that they are going to sex and mate some flies. First, they have to look for the information on the web and later, they have to complete the information but walking around the classroom and getting the information from the information posters on the walls. They do both activities in groups.

Fill in the information missing about the fly by surfing the Web.

Classification	
Domain:	Eukarya
Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Diptera
Family	Drosophilidae
Genus	Drosophila
Species	melanogaster

Now, read the poster on the walls and complete the information missing.



Drosophila melanogaster exhibits complete metamorphism

The larval stage has three instars, or molts.

It takes 12 days for the *Drosophila melanogaster* to become adult.

Females become sexually mature 8-10 hours after eclosion

The time to the eclosion varies according to the temperature.

The optimal temperature is from 18ºC to 22ºC.

Females can lay up to 100 eggs per day.

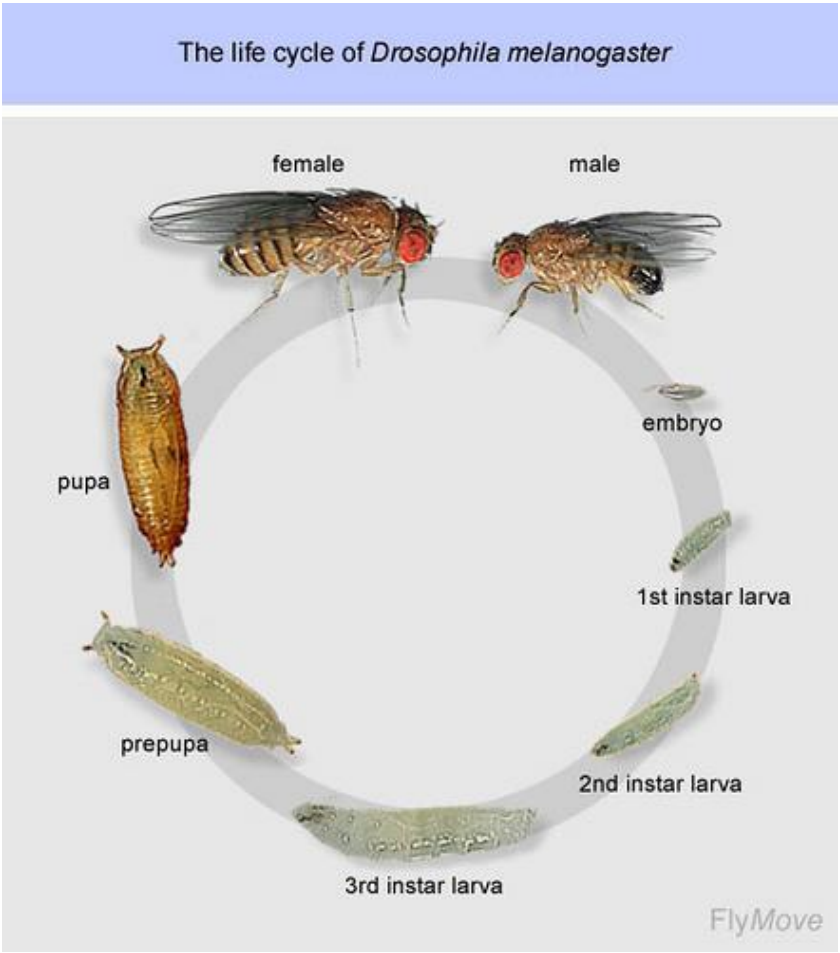
Eggs from virgin females will be sterile.

Template adapted from CLIL-SI 2015.
More information at: http://grupsderecerca.uab.cat/clilsi/

POSTER ONE:

Life cycle of *Drosophila melanogaster*

Drosophila melanogaster exhibits complete metamorphism, meaning the life cycle includes an egg, larval (worm-like) form, pupa and finally emergence (eclosure) as a flying adult. This is the same as the well-known metamorphosis of butterflies. The larval stage has three instars, or molts.



Day 0: Female lays eggs

Day 1: Eggs hatch

Day 2: First instar (one day in length)

Day 3: Second instar (one day in length)

Day 5: Third and final instar (two days in length)

Day 7: Larvae begin roaming stage. Pupariation (pupal formation) occurs 120 hours after egg laying

Day 11-12: Eclosion (adults emerge from the pupa case).

POSTER TWO

Life cycle of *Drosophila melanogaster*

Females become sexually mature 8-10 hours after eclosion.

The generation time of *Drosophila melanogaster* varies with temperature. The above cycle is for a temperature of about 22°C. Flies raised at lower temperature (to 18°C) will take about twice as long to develop.

Females can lay up to 100 eggs/day.

Virgin females are able to lay eggs. However, they will be sterile and few in number.

After the eggs hatch, small larvae should be visible in the growing medium. If your media is white, look for the small black area (the mouth hooks) at the head of the larvae. Some dried premixed media is blue to help identify larvae. However, this is not a necessity and with a little patience and practice, larvae are easily seen. In addition, as the larvae feed, they disrupt the smooth surface of the media and so by looking only at the surface one can tell if larvae are present. However, it is always a good idea to double check using a stereo microscope. After the third instar, larvae will begin to migrate up the culture vial in order to pupate.

Sexing and mating

Now is time to sex and mate. Study these pictures carefully. Pay special attention to the differences between males and females.

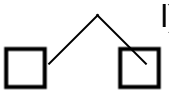
Ventral view of a male (top) and female (bottom).

Lateral view of a male (top) and female (bottom).

We'll drop a cotton on ethylic ether and carefully pass it near the flies. N**ever** touch the flies with ethylic ether. Carefully with a brush classify the males and females. And mate them in the vials that teacher will provide you.

IX.- How to build a pedigree.

Match pedigree symbols with their descriptions

Symbol	Description
a) 	Unaffected male
b) 	Unaffected female
c) 	Affected male
d) 	Affected female
e) 	Deceased male
f) 	Deceased female
g) 	Possibly affected male or unknown
h) 	Possibly affected female or unknown
i) 	Carrier male of autosomal recessive disorder
j) 	Carrier female of autosomal recessive disorder
k) 	Carrier female with an X-linked disorder
l) 	twins
m) 	couple

Coriell Institute for Medical Research. Pedigree Symbol Definitions. 1998

Problem

Now, you're ready to solve a few Problems. Let's go.

Activities:

1.Draw a pedigree that represents Aina married to Jaume, with one daughter, Ainara.

Ainara married to Jordi and had Adrià and Lluís. Lluís married Júlia and had Èrica and fraternal twin boys, Marc and Àlex. Marc who is a carrier of autosomal recessive disorder married Laura who is a carrier of autosomal recessive disorder too and had Pere and Maria who were affected for the disorder. Please label the pedigree with names of the people.

Allow 10 minutes to draw the pedigree and correct together. You can also ask them to do it as homework.

Build your own pedigree and give conclusions. Use http://pedigreedraw.com/ (you need to sign in) or https://pedigree.progenygenetics.com/ (online, you don't need to register)

Allow 10 minutes to draw the pedigree and correct together. You can also ask them to do it as homework.

X.- Our experiment.

Now it is time to see the result of our mating.

		Which Mendel law applies to this proportion?
Number of w+ *Drosophila*		
Number of se *Drosophila*		
Number of ve *Drosophila*		

Sometimes, the results will not be clear as we did not take into account that they could have mated another drosophila so they may be the second or third generation.

Now, you can draw the pedigree with the genotypes and phenotypes.

Write the lab report

Remember a good lab report format includes six main sections:

- Title
- Introduction or Hypothesis
- Materials and Methods
- Results
- Conclusion

Keep in mind that individual instructors may have a specific format that they require you to follow. Please be sure to consult your teacher about the specifics of what to include in your lab report.

Title: The title states the focus of your experiment. The title should be to the point, descriptive, accurate, and concise (ten words or less). If your instructor requires a separate title page, include the title followed by the name(s) of the project participant(s), class title, date, and instructors name. If a title page is required, consult your instructor about the specific format for the page.

Introduction: The introduction of a lab report states the purpose of your experiment. Your hypothesis should be included in the introduction, as well as a brief statement about how you intend to test your hypothesis.

To be sure that you have a good understanding of your experiment, some educators suggest writing the introduction after you have completed the methods and materials, results, and conclusion sections of your lab report.

Methods and Materials: This section of your lab report involves producing a written description of the materials used and the methods involved in performing your experiment. You should not just record a list of materials, but indicate when and how they were used during the process of completing your experiment.

The information you include should not be overly detailed but should include enough detail so that someone else could perform the experiment by following your instructions.

Results: The results section should include all tabulated data from observations during your experiment. This includes charts, tables, graphs, and any other illustrations of data you have collected. You should also include a written summary of the information in your charts, tables, and/or other illustrations. Any patterns or trends observed in your experiment or indicated in your illustrations should be noted as well.

Discussion and Conclusion: This section is where you summarize what happened in your experiment. You will want to fully discuss and interpret the information. What did you learn? What were your results? Was your hypothesis correct, why or why not? Were there any errors? If there is anything about your experiment that you think could be improved upon, provide suggestions for doing so.

Now meet a class mate and assess his/ her report.

A positive thing my class mate said about my report is ...	

Template adapted from CLIL-SI 2015.
More information at: http://grupsderecerca.uab.cat/clilsi/

A thing to improve my class mate said about my report is ...	

XI.- Our Research

We are going to design and carry out an experiment to know if *Drosophila melanogaster* could have homosexual behaviour or not.
Research question: Are *Drosophila melanogaster* homosexual?
How can we design an experiment to discover if *Drosophila melanogaster* are or are not homosexual?

First read the web pages on Moodle for ideas. List your references

Author's Name. *Full title of work (in quotation marks)*. Document date (if known), Full http address, Date of visit.

-

-

-

Books

Author. *Title of Book*. City of Publication: Publisher, Year.

-

-

-

From the readings, how can you design your experiment? Write down what you are going to do.

What are we going to do to prove the hypothesis?	
Is it feasible?	
Is it research-worthy?	
What do we need to carry it out? List the equipment and resources needed	

Benchmark: A Star and a Wish

Take two post-its for each group in the class. Listen to their proposals and write down a praise and a suggestion for each one.

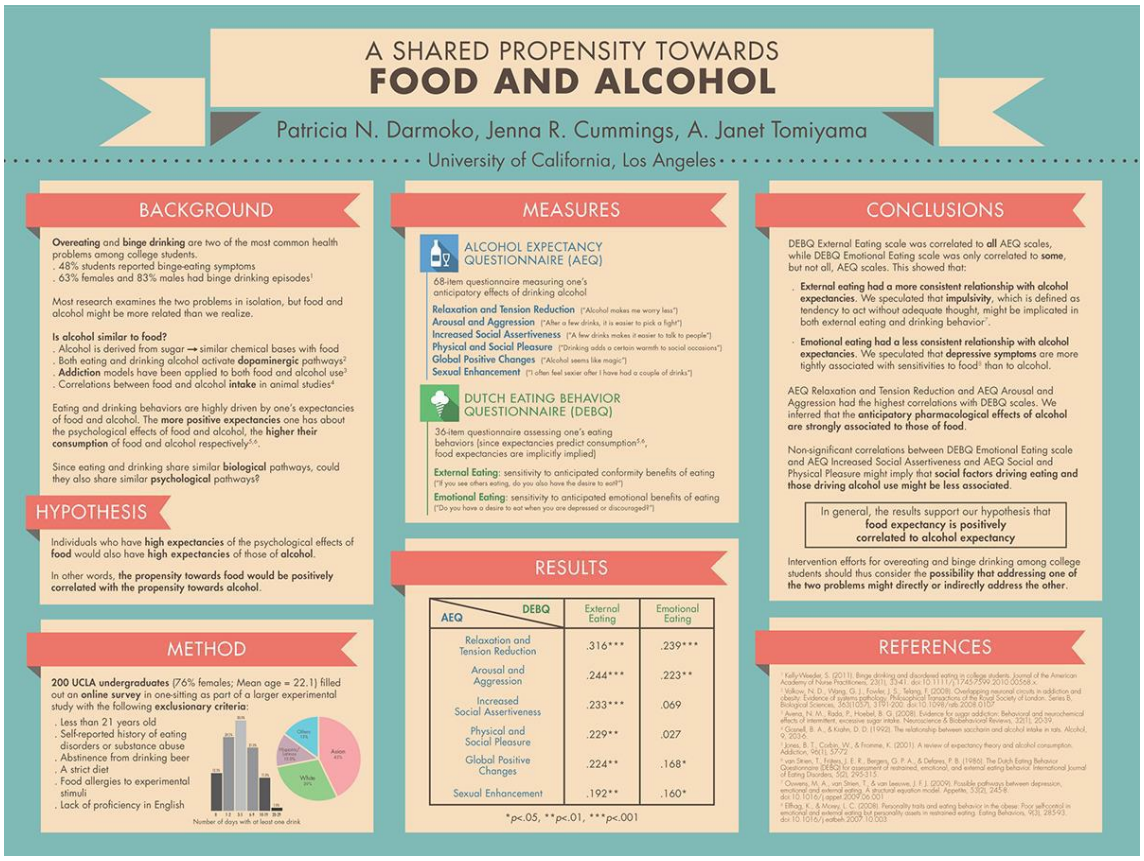
Explain your experiment to your classmates and listen to their comments.

Improvements from the feedback

Carry out your experiment and answer the questions at the light of your results.

XII.- A scientific poster

But before we start, let's think about it. Go to Moodle® and analyse the scientific poster there.



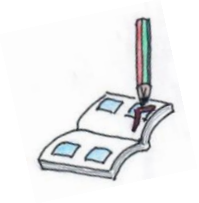
https://www.behance.net/gallery/30160927/Scientific-Posters

Which things need to be done to design a scientific poster.

Aspects to bear in mind	They will be correct if ...
Content	1. 2. 3. 4.
	1. 2. 3. 4.
	1. 2. 3. 4.

	1. 2. 3.

Once the templates are designed, place them on the padlet® https://padlet.com/montseirun/j5sid7nlch1y



Assess your work

I. Go to our padlet ®. We are going to assess our peers' profiles using the rubric that we designed in the last section.

Scientific poster Rubric

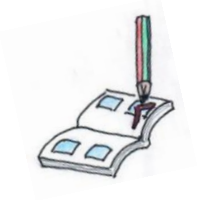
	Expert (5)	Good (3)	Not very well (2)	Needs to improve (1)
Content				

	content			
Group 1				
Group 2				
Group 3				
Group 4				

II. Now it is time to assess your group work. Paint the box that most describes you as a group.

Group work rubric

	Expert (5)	Good (3)	Not very well (2)	Needs to improve (1)
Responsibility	We worked well together. We helped each other and have done all the tasks on time.	We worked on our own but not always together. We did not work always hard. The tasks were not always on time.	We did not work together. We should have worked hard and tried to do the tasks on time.	We did not do much and one or more tasks were not finished or done.
Collaboration	We all collaborated actively when carrying out the tasks.	There was one or more member who sometimes did not do their jobs on time.	There was one or more member who not do their jobs on time	We did not work as a team.
Organization	We organized ourselves well and the teacher did have to intervene.	We organized ourselves quite well and the teacher only had to intervene once.	We did not organize ourselves well and the teacher had to intervene sometimes.	We did not organize ourselves and the teacher had to intervene a lot.



When you collect the handout, paint the box with a different colour if you disagree. It is then a good idea to talk to the students to agree on the criteria.

1. What went well with your project?

2. What didn't go so well with your project?

3. How well did you/your group stay on task to meet deadlines? And how well did you work together with your group?

4. What would you do differently if you were to do your exhibition over again? What recommendations do you have for a student doing this project next year?

5. What was the most enjoyable part of your project?

7. What was the most difficult part of your project?