# DP unit planner 3

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| **Teacher(s)**  | Alejandro Franco | **Subject group and course** | Group 4, Biology  |
| **Course Part and topic** | Meiosis, Karyograms and Karyotyping | **SL or HL/Year 1 or 2** | HL/1 | **Dates** | April 2013Semester 2 |
| **Unit description and texts** | **DP assessment(s) for unit** |
| A detailed look at meiosis, variation and the relation with sexual reproduction. Topic 4.2 for both SL and HL and 10.1 for HL, in preparation for papers 1 and 2. Biology course companion (Oxford) and Higher Level Biology (Pearson) textbooks | * Paper 1, Multiple choice
* Paper 2, Data based, short and extended response
* PSOW 4, Computer models and simulations, use of databases
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***INQUIRY: establishing purpose of the unit***

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| **Transfer goals***List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to “transfer”, or apply, their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.* |
| 1. Students will understand how genes combine to provide new combinations that are different from both parents (variation), how this is a consequence of cell division, and how these combinations reflect the effects of the environment.
2. Students will demonstrate their understanding by writing organized, precisely worded essays and short answers that use support from annotated diagrams of the different stages of meiosis and its relationship with sexual reproduction, as well as interpreting and analysing karyograms.
3. Students will demonstrate their understanding of the effects of having access to the information in a person’s genetic makeup by effectively researching, discussing and debating the topics of abortion, gender selection, genetic screening and chromosomal abnormalities.
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| **Essential understandings** *List here the key content/skills/concepts that students will know/develop by the end of the unit.* |
| Students will know the following content:1. Students will be able to define what a homologous chromosome is, as well as distinguish between them and sister chromatids.
2. Students will be able to state that meiosis is a reduction division of a diploid nucleus to form haploid nuclei.
3. Student will be able to state Mendel’s Law of Independent Assortment.
4. Students will be able to state that a karyogram shows the chromosomes of an organism in homologous pairs of decreasing length.
5. Students will be able to distinguish between meiosis and mitosis.
6. Students will be able to outline the stages of meiosis and describe the behaviour of chromosomes in these.
7. Students will be able to outline the relationship between crossing over, homologous chromosomes, random orientation and variation.
8. Students will be able to describe the methods of obtaining cells for making a karyogram.
9. Students will be able to explain the relationship between karyotypes, non-disjunction and meiosis.

Students will develop the following skills:1. Students will be able to identify the stages of meiosis by looking at cells through a microscope.
2. Students will be able to identify the stages of meiosis by staining tissues containing germ-line cells.
3. Students will be able to identify the stages of meiosis when looking at diagrams.
4. Students will be able to make annotated diagrams of the stages of meiosis.
5. Students will explain and analyse a karyogram.
6. Students will be able to write about the relationship between meiosis, variation, sexual reproduction and evolution.

Students will grasp the following concepts:1. Certain beliefs remain in a culture for long periods of time.
2. Gender discrimination and pre-natal screening can lead to increased rates of abortion.
3. Social stigmatization has an effect on family life.
4. Scientific discoveries require time, meticulous observations and acceptance by the scientific community.
5. There are differences between laws and theories in science.
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| **Missed concepts/misunderstandings***List here likely misunderstandings students may have during the unit with relation to skills, content and concepts.* |
| Content-based:1. Chromosomes, chromatin and chromatids are different in both the time of the life cycle when they exist, as well as how they behave.
2. Both meiosis I and II can lead to non-disjunction, and this can happen in men and women.
3. If a cell is undergoing meiosis with non-disjunction it can produce cells that have more than and less than the ideal number of chromosomes.
4. Not all cells have 23 pairs of chromosomes in humans, let alone in other species.
5. Independent assortment and random orientation of chromosomes are associated but are two different concepts.

Skills-based:1. Identifying the stage of meiosis a cell is at through the microscope can be difficult as a cell can be starting one stage and finishing another at the same time.
2. Understanding a karyotype is not usually a problem, however representing it with a proper genetic notation is trickier.
3. Common misconception of what the X and Y chromosomes look like in a karyotype.
4. Onion root tip squash is meticulous and precise; students usually struggle with the manipulation.

Concepts-based:1. Common misconception that the reasons people seek abortion are singular, simple, and ethically clear.
2. Common misconception that understanding our genetic information has happened for a long time.
3. Common misconception that a law is the same as a theory.
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| **Inquiry questions***List here the understandings above written in question form, preferably as ones that inspire students to answer them. Feel free to create additional questions that help inspire further inquiry in the unit but may not directly connect to an above essential understanding.* |
| Content-based:1. What is meiosis and how does it happen?
2. When and where does meiosis happen?
3. What are the differences between a homologous chromosome and sister chromatids?
4. What are the differences between these and chromatin?
5. How are Mendel’s laws associated with meiosis?
6. What is a karyogram and what does it show?
7. What is the difference between a karyogram and a karyotype?
8. What is the difference between meiosis and mitosis?
9. What are the stages of meiosis? What happens to the chromosomes in these stages?
10. What is the relationship between crossing over, homologous chromosomes, random orientation and variation?
11. What happens if meiosis goes wrong? How do you know?
12. What is the relationship between karyotypes, non-disjunction and meiosis?

Skills-based:1. What does a cell undergoing meiosis look like through a microscope?
2. How do diagrams of cells undergoing meiosis look like?
3. How do you obtain cells for making a karyogram?
4. How do you analyse a karyogram?
5. How can you explain the relationship between meiosis, variation, sexual reproduction and evolution?

Concepts-based:1. What role do biological and genetic factors play in someone’s decision to undergo an abortion?
2. Who should have access to the genetic information of a patient?
3. Who should control what can and can’t be done with the genetic information of an individual?
4. What makes religious/cultural beliefs so difficult to change? When is it acceptable that they don’t?
5. If you are aware of the risks of having a child, should you still decide to?
6. Why are scientists resilient to change? Why are scientific “truths” difficult to change?
7. Can a theory become a law?
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***ACTION: teaching and learning through inquiry***

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| **Essential understanding goals***Copy and paste the essential understanding goals from above “Inquiry” section.* | **Assessment of essential understanding goals***Write a 1:1 matching assessment for all goals. Assessments should be labelled formative (F) or summative (S).*  | **Learning process***Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.* |
| Students will know the following content:1. Students will be able to define what a homologous chromosome is, as well as distinguish between them and sister chromatids.
2. Students will be able to state that meiosis is a reduction division of a diploid nucleus to form haploid nuclei.
3. Students will be able to state Mendel’s Law of Independent Assortment.
4. Students will be able to state that a karyogram shows the chromosomes of an organism in homologous pairs of decreasing length.
5. Students will be able to distinguish between meiosis and mitosis.
6. Students will be able to outline the stages of meiosis and describe the behaviour of chromosomes in these.
7. Students will be able to outline the relationship between crossing over, homologous chromosomes, random orientation and variation.
8. Students will be able to describe the methods of obtaining cells for making a karyogram.
9. Students will be able to explain the relationship between karyotypes, non-disjunction and meiosis.

Students will develop the following skills:1. Students will be able to identify the stages of meiosis by looking at cells through a microscope.
2. Students will be able to identify the stages of meiosis by staining tissues containing germ-line cells.
3. Students will be able to identify the stages of meiosis when looking at diagrams.
4. Students will be able to make annotated diagrams of the stages of meiosis.
5. Students will explain and analyse a karyogram.
6. Students will be able to write about the relationship between meiosis, variation, sexual reproduction and evolution.

Students will grasp the following concepts:1. Certain beliefs remain in a culture for long periods of time.
2. Gender discrimination and pre-natal screening can lead to increased rates of abortion.
3. Social stigmatization has an effect on family life.
4. Scientific discoveries require time, meticulous observations and acceptance by the scientific community.
5. There are differences between laws and theories in science.
 | Content-based: 1. Meiosis quizzes and tests (S), written description of meiosis (F), semester exam
2. Meiosis quizzes and tests (S), written description of meiosis (F), semester exam
3. Meiosis quizzes and tests (S), semester exam
4. Meiosis quizzes and tests (S), online activity (F), semester exam
5. Meiosis quizzes and tests (S), diagram comparison of stages of mitosis and meiosis (F); semester exam (S)
6. Meiosis quizzes and tests (S), diagram and flow chart of stages of meiosis (F), written description of meiosis (F), semester exam
7. Meiosis quizzes and tests (S), written description of meiosis (F), essay on the relationship between meiosis, variation, sexual reproduction and evolution (S), semester exam
8. Meiosis quizzes and tests (S), online activity (F), semester exam
9. Meiosis quizzes and tests (S), written description of meiosis (F), online activity (F), semester exam

Skills-based:1. Looking at meiosis through the microscope (F); onion root tip squash lab (F); meiosis online activity (F), Semester exam (S).
2. Onion root tip squash lab (F); exercise based on images obtained from the internet (F); semester exam (S).
3. Meiosis quizzes and tests (S), diagram and flow chart of stages of meiosis (F), written description of meiosis (F), semester exam
4. Meiosis quizzes and tests (S), diagram and flow chart of stages of meiosis (F), written description of meiosis (F), semester exam
5. Online activity (F), group presentation (S) and class discussion (F); semester exam (S).
6. Online research (F), written description of meiosis (F), essay on the relationship between meiosis, variation, sexual reproduction and evolution (S), semester exam (S).

Concept-based:1. Group presentations (S) and class discussion (F), chromosomal abnormality research (F). semester exam (S).
2. Karyotyping activity online(S), group presentations (S) and class discussion (F), chromosomal abnormality research (F), semester exam (S).
3. Group presentations (S) and class discussion (F), chromosomal abnormality research (F), semester exam (S).
4. Class discussion (F)
5. Class discussion (F)
 | [ ] Lecture[ ] Socratic seminar[x] Small group/pair work[x] Powerpoint lecture/notes[ ] Individual presentations[x] Group presentations[ ] Student lecture/leading[x] Interdisciplinary learningDetails: [x] Other/s:Online activity and research.Class discussion. |

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| **Resources** |
| Pearson Baccalaureate: Higher Level Biology (and weblinks)Oxford: Biology Course CompanionMeiosis and Mutations presentations (see links)Karyotyping activity: http://www.biology.arizona.edu/human\_bio/activities/karyotyping/karyotyping.htmlGene linkage: http://www.slideshare.net/gurustip/dihybrid-crosses-gene-linkage-and-recombination.html |

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| **Approaches to learning (ATL)***Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see* [*the guide*](http://ibpublishing.ibo.org/dpatl/guide.html)*.* | **Metacognition***Check the boxes for any metacognitive approaches used that ask students to reflect on unit content, their own skills, or unit concepts. For more information on the IB’s approach to metacognition, please see the ATL guide* [*the guide*](http://ibpublishing.ibo.org/dpatl/guide.html)*.* | **Differentiation:***For more information on the IB’s approach to differentiation, please see* [*the guide*](http://ibpublishing.ibo.org/dpatl/guide.html)*.* |
| [ ] Thinking[ ] Social[x] Communication[ ] Self-management[x] ResearchDetails: Individual and group research and presentations | [ ] Reflection on content[x] Reflection on skills[ ] Reflection on conceptsDetails: microscope lab simulations online, annotation of diagrams | [ ] Affirm identity —build self-esteem[ ] Value prior knowledge[ ] Scaffold learning[ ] Extend learningDetails: |
| **Language and learning***Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB’s approach to language and learning, please see* [*the guide*](http://ibpublishing.ibo.org/dpatl/guide.html)*.* | **TOK connections***Check the boxes for any explicit TOK connections made during the unit.* | **CAS connections***Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the “details” section explaining how students engaged in CAS for this unit.* |
| [ ] Activating background knowledge[ ] Scaffolding for new learning[x] Acquisition of new learning through practice[x] Demonstrating proficiencyDetails: annotation of diagrams, quizzes and semester exam | [ ] Personal and shared knowledge[ ] Ways of knowing[x] Areas of knowledge[ ] The knowledge frameworkDetails: Natural sciences | [ ] Creativity[ ] Activity[ ] ServiceDetails:  |

***REFLECTION: Considering the planning, process and impact of the inquiry***

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| **What worked well** | **What didn’t work well** | **Notes/changes/suggestions:** |
| * Comparison diagrams between mitosis and meiosis, students were able to understand and visualize the differences in the two processes.
* Online activities were engaging, fun, informative and challenging.
* Meiosis in cells through a lab was challenging and helped students see that it is not always quite clear or easy to identify the cells.
* Chromosomal abnormality research, students’ interest and understanding of meiosis increased as it made it more real for them; it also brought questions about male and female processes and discussions about age and reproduction.
* Reinforcement of the differences between homologous chromosomes and sister chromatids, in the diagram and the flow chart, helped students understand the different stages of the process more clearly.
* Essay writing was very productive, though students do not really like to write long essays in class. The research and practice of putting things in paragraph form reinforced their knowledge, helped them clarify concepts and practice their communication skills to ensure meaning was being passed on.
* Use of practice problems and past paper questions helped them get familiar with examiner expectations and standards.
 | * Onion root tip squash was long and difficult for manipulation. Few clear results were obtained.
* A connection with gene linkage should have been made here to clarify crossing over.
* The discussion on the differences between meiosis in men and woman was confusing for some students who struggled with the idea of “one” cell being produced.
* Some students struggled to separate gene mutation from chromosomal mutations.
* Misconception that not all organisms have 23 pairs of chromosomes, even though this was reinforced throughout, in the semester exam multiple choice question, this question was wrong by more than one student.
* Comparison of sampling techniques was a little vague, more focus or maybe in class rather than homework assignment.
 | * Taking some time to explain gene linkage to reinforce crossing-over, or alternatively not mentioning gene linkage at all in this module.
* Clear explanation of gametogenesis in men and women.
* A good discussion on ethical implications of karyotyping can be done, associated with abortion and gender selection.
* Carefully look at which ATL can be used and reinforce these more in the struggling students.
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| **Transfer goals***List the transfer goals from the beginning of this unit planner.* |
| 1. Students will understand how genes combine to provide new combinations that are different from both parents (variation), how this is a consequence of cell division, and how these combinations reflect the effects of the environment.
2. Students will demonstrate their understanding by communicating in developed, organized and precisely worded commentaries that use support from annotated diagrams of the different stages of meiosis and its relationship with sexual reproduction, as well as interpreting and analysing Karyograms.
3. Students will demonstrate their understanding of the effects of having access to the information in a person’s genetic makeup by conducting research and discussing and debating about the topics of abortion, gender selection, genetic screening and chromosomal abnormalities.
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| **Transfer reflection***How successful were the students in achieving the transfer goals by the end of the unit?* |
| Both students and I felt that this was a good experience, and that it was useful. Students felt well prepared, as they had practised these skills with the exercises in class and the data questions, as well as the online activities.Students were capable of achieving transfer goals 1 and 2, though struggled with transfer goal 3 in that they struggled to stay logical and empirical and not get emotional; this is a huge area ripe for improvement (debate, Socratic seminar, etc.) that would make connections with other areas clearer. Overall, I feel that the transfer goals were met and that the assessments, both formative and summative, were adequately designed to facilitate transfer in these areas. |