IB aligned Reading Note Guide
The Cell Cycle: Chapter 12-Campbell & Reece, 2007

General Reminders:

These Guides Help you keep your eye on the IB Ball

-65-75% (significantly more than ½, but not to the exclusion of all other information) of your notes should be focused on the IB standards
- make sure you actually know what the IB Command terms in each standard mean!!!

-the other 35-25% should be supporting connections, details, and concepts that help you better understand life (biology) and how it connects with you (personally) and/or the natural world and universe

Ms. Del worked hard creating these Reading Notes for you, make sure to use them wisely!

Grading Guidelines

Full Credit: Complete, Quality Notes that fulfills the assignment's expectations and is organized such that your MATH teacher could understand your notes.
"11/15"*: Complete Organized Notes that have a minor issue (classic examples include failure to follow Figure note taking guidelines OR lack of evidence that you "Reevaluated" your notes after completing the reading.)
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Preferred Format: Cornell Style

	First Last Name Date/Due Date Period
Assignment Title	
"Cues" /Main idea column ← 2-3inches→ At a minimum: include the section heading descriptions & numbers, But it is **preferred that longer/more complex** sections include at least 1-3 additional relevant "cues"/ main ideas	**Note Column** ←6 ½ -5 ½ inches→
Summary*	

Quick reference: http://lsc.cornell.edu/LSC_Resources/cornellsystem.pdf
*FYI: I find that rather than summarizing at the bottom of each binder paper page, that instead summarizing at the end of a section/chapter/assignment is more effective in Biology.

Unit Specific Details

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Minimum required "Cues" /Main idea	Relevant IB standards to help you evaluate what notes to take and how to take them! **Note Column**
Overview: The Key Roles of Cell Division	**From Topic 1.6** **Essential idea:** Cell division is essential but must be controlled.
Ch12.1 Cell division results in genetically identical daughter cells	**From Topic 1.6** **Understandings:** • Mitosis is division of the nucleus into two genetically identical daughter nuclei. **Guidance:** • To avoid confusion in terminology, teachers are encouraged to refer to the two parts of a chromosome as sister chromatids, while they are attached to each other by a centromere in the early stages of mitosis. From anaphase onwards, when sister chromatids have separated to form individual structures, they should be referred to as chromosomes. -Intro to 3.2 Chromosomes, 3.3 Meiosis, 3.4 Inheritance, 10.1 Meiosis **From Topic 3.1** **Understandings:** • The genome is the whole of the genetic information of an organism.
Ch 12.2 The mitotic phase alternates with interphase in the cell cycle.	**From Topic 1.6** **Understandings:** • Chromosomes condense by supercoiling during mitosis. • Cytokinesis occurs after mitosis and is different in plant and animal cells. • Interphase is a very active phase of the cell cycle with many processes occurring in the nucleus and cytoplasm. **Applications and skills:** • Skill: Identification of phases of mitosis in cells viewed with a microscope or in a micrograph. • Skill: Determination of a mitotic index from a micrograph. **Guidance:** • The sequence of events in the four phases of mitosis should be known. • Preparation of temporary mounts of root squashes is recommended but phases in mitosis can also be viewed using permanent slides. ***From Topic 1.1*** *(in PowerPoint lecture)* ***Understandings:*** • *Specialized tissues can develop by cell differentiation in multicellular organisms.* • *Differentiation involves the expression of some genes and not others in a cell's genome.* • *The capacity of stem cells to divide and differentiate along different pathways is necessary in embryonic development and also makes stem cells suitable for therapeutic uses.* ***Applications and skills:*** • *Application: Use of stem cells to treat Stargardt's disease and one other named condition.* • *Application: Ethics of the therapeutic use of stem cells from specially created embryos, from the umbilical cord*

	blood of a new-born baby and from an adult's own tissues. ***International-mindedness:*** *• Stem cell research has depended on the work of teams of scientists in many countries who share results thereby speeding up the rate of progress. However, national governments are influenced by local, cultural and religious traditions that impact on the work of scientists and the use of stem cells in therapy.* ***Utilization:*** *• The use of stem cells in the treatment of disease is mostly at the experimental stage, with the exception of bone marrow stem cells. Scientists, however, anticipate the use of stem cell therapies as a standard method of treating a whole range of diseases in the near future, including heart disease and diabetes.* ***Aim 8:** There are ethical issues involved in stem cell research, whether humans or other animals are used. Use of embryonic stem cells involves the death of early-stage embryos, but if therapeutic cloning is successfully developed the suffering of patients with a wide variety of conditions could be reduced.*
Ch 12.3 The cell cycle is regulated by a molecular control system	**From Topic 1.6** **Nature of science:** Serendipity and scientific discoveries—the discovery of cyclins was accidental (1.4). **Understandings:** • Cyclins are involved in the control of the cell cycle. • Mutagens, oncogenes and metastasis are involved in the development of primary and secondary tumours. **Applications and skills:** • Application: The correlation between smoking and incidence of cancers. **International-mindedness:** • Biologists in laboratories throughout the world are researching into the causes and treatment of cancer. **Utilization:** • The mitotic index is an important prognostic tool for predicting the response of cancer cells to chemotherapy. **Aim 8:** The tobacco industry could be discussed. Suppression of the results of research by tobacco companies into the health effects of smoking tobacco was unethical. Smoking causes considerable social harm, but, with the exception of laws on production and supply in Bhutan, has never been made illegal. **From Topic 3.4** **Understandings:** • Radiation and mutagenic chemicals increase the mutation rate and can cause genetic diseases and cancer. **Applications and skills:** • Application: Consequences of radiation after nuclear bombing of Hiroshima and accident at Chernobyl. **From Topic 6.4** **Applications and skills:** • Application: Causes and consequences of lung cancer. **Aim 8:** The social consequences of lung cancer and emphysema could be discussed.

IB aligned Reading Note Guide
Meiosis and Sexual Life cycles: Chapter 13-Campbell & Reece, 2007

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Unit Specific Details

IB aligned Reading Note Guide
Meiosis and Sexual Life cycles: Chapter 13-Campbell & Reece, 2007

Minimum required	Relevant IB standards to help you evaluate what notes to take and how to take them!

"Cues" /Main idea	**Note Column**
Overview: Hereditary similarity and Variation	**From Topic 3.1** **Essential idea:** Every living organism inherits a blueprint for life from its parents. *-Prep for Topic 9.4 Reproduction in Plants*
Ch 13.1 Offspring acquire genes from parents by inheriting chromosomes	**From Topic 3.1** **Understandings:** • A gene is a heritable factor that consists of a length of DNA and influences a specific characteristic. • A gene occupies a specific position on a chromosome. **From Topic 3.3** **Nature of science:** Making careful observations—meiosis was discovered by microscope examination of dividing germ-line cells (1.8). **From Topic 3.4** **Understandings:** • Gametes are haploid so contain only one allele of each gene. **From Topic 3.5** *(further discussed in the Biotech Mini-Unit of HL 1 and reinforced in HL 2)* **Understandings:** • Clones are groups of genetically identical organisms, derived from a single original parent cell. • Many plant species and some animal species have natural methods of *cloning.* • *Animals can be cloned at the embryo stage by breaking up the embryo into more than one group of cells.* • *Methods have been developed for cloning adult animals using differentiated cells.* • *Application: Production of cloned embryos produced by somatic-cell nuclear transfer.* **From Topic 6.6** *(further discussed in the Sexual Reproduction Mini-Unit of HL 1)* ***Understandings:*** • *A gene on the Y chromosome causes embryonic gonads to develop as testes and secrete testosterone.*
Ch 13.2 Fertilization and meiosis alternate in sexual life cycles	**From Topic 3.2** **Essential idea:** Chromosomes carry genes in a linear sequence that is shared by members of a species. **Nature of science:** Developments in research follow improvements in techniques—autoradiography was used to establish the length of DNA molecules in chromosomes (1.8). **Understandings:** •In a eukaryote species there are different chromosomes that carry different genes. • Homologous chromosomes carry the same sequence of genes but not necessarily the same alleles of those genes. • Diploid nuclei have pairs of homologous chromosomes. • Haploid nuclei have one chromosome of each pair. • The number of chromosomes is a characteristic feature of members of a species. • A karyogram shows the chromosomes of an organism in homologous pairs of decreasing length. • Sex is determined by sex chromosomes and autosomes are chromosomes that do not determine sex. **Applications and skills:** • Application: Cairns' technique for measuring the length of DNA molecules by autoradiography. • Application: Comparison of diploid chromosome numbers of *Homo sapiens*, *Pan troglodytes*, *Canis familiaris*, *Oryza sativa*, *Parascaris equorum.* • Application: Use of karyograms to deduce sex and diagnose Down syndrome in humans. **Guidance:** • The terms karyotype and karyogram have different meanings. Karyotype is a property of a cell—the number and type of chromosomes present in the nucleus, not a photograph or diagram of them. • Genome size is the total length of DNA in an organism. The examples of genome and chromosome number have been selected to allow points of interest to be raised. • **Aim 6:** Staining root tip squashes and microscope examination of chromosomes is recommended but not obligatory. **From Topic 3.4** **Understandings:** • Fusion of gametes results in diploid zygotes with two alleles of each gene that may be the same allele or different alleles. -Review of Topic 1.6 Cell division -Prep for Topic 6.6 Hormones, homeostasis, and reproduction, Topic 9.4 Reproduction in plants, Topic 11.4 Sexual reproduction *The following standards are introduced in the Meiosis Unit, but will be further discussed in the Sexual Reproduction Mini-Unit (Chapter 45 & 46 of Campbell).* ***From Topic 6.6*** ***Understandings:*** • *A gene on the Y chromosome causes embryonic gonads to develop as testes and secrete testosterone.* ***From Topic 11.4*** ***Essential idea:*** *Sexual reproduction involves the development and fusion of haploid gametes.* ***Nature of science:*** *Assessing risks and benefits*

	• *Testosterone causes pre-natal development of male genitalia and both sperm production and development of male secondary sexual characteristics during puberty.* • *Estrogen and progesterone cause pre-natal development of female reproductive organs and female secondary sexual characteristics during puberty.* • *The menstrual cycle is controlled by negative and positive feedback mechanisms involving ovarian and pituitary hormones.* ***Applications and skills:*** • *Application: The use in IVF of drugs to suspend the normal secretion of hormones, followed by the use of artificial doses of hormones to induce superovulation and establish a pregnancy.* • *Application: William Harvey's investigation of sexual reproduction in deer.* • *Skill: Annotate diagrams of the male and female reproductive system to show names of structures and their functions.* ***Guidance:*** • *The roles of FSH, LH, estrogen and progesterone in the menstrual cycle are expected.* • *William Harvey failed to solve the mystery of sexual reproduction because effective microscopes were not available when he was working, so fusion of gametes and subsequent embryo development remained undiscovered.* ***Utilization:*** • *Hormones are used in a variety of therapies such as replacement therapies.* ***Aim 8:*** *Scientists are aware that the drugs women take in fertility treatment pose potential risks to health. Should scientific knowledge override compassionate considerations in treating infertile couples?* *-Review of Topic 3.3 Meiosis*	*associated with scientific research—the risks to human male fertility were not adequately assessed before steroids related to progesterone and estrogen were released into the environment as a result of the use of the female contraceptive pill (4.8).* ***Understandings:*** • *Spermatogenesis and oogenesis both involve mitosis, cell growth, two divisions of meiosis and differentiation.* • *Processes in spermatogenesis and oogenesis result in different numbers of gametes with different amounts of cytoplasm.* • *Fertilization in animals can be internal or external.* • *Fertilization involves mechanisms that prevent polyspermy.* • *Implantation of the blastocyst in the endometrium is essential for the continuation of pregnancy.* • *HCG stimulates the ovary to secrete progesterone during early pregnancy.* • *The placenta facilitates the exchange of materials between the mother and fetus.* • *Estrogen and progesterone are secreted by the placenta once it has formed.* • *Birth is mediated by positive feedback involving estrogen and oxytocin.* ***Applications and skills:*** • *Application: The average 38-week pregnancy in humans can be positioned on a graph showing the correlation between animal size and the development of the young at birth for other mammals.* • *Skill: Annotation of diagrams of seminiferous tubule and ovary to show the stages of gametogenesis.* • *Skill: Annotation of diagrams of mature sperm and egg to indicate functions.* ***Guidance:*** • *Fertilization involves the acrosome reaction, fusion of the plasma membrane of the egg and sperm and the cortical reaction.* ***Aim 8:*** *Disputes over the responsibility for frozen human embryos.* *-Review of Topic 3.3 Meiosis* *-Prep for Topic 6.6 Hormones, homeostasis and reproduction*
Ch 13.3 Meiosis reduces the number of chromosome sets from diploid to haploid	**From Topic 3.2** **Guidance:** • The two DNA molecules formed by DNA replication prior to cell division are considered to be sister chromatids until the splitting of the centromere at the start of anaphase. After this, they are individual chromosomes. **From Topic 3.3** **Understandings:** • One diploid nucleus divides by meiosis to produce four haploid nuclei. • The halving of the chromosome number allows a sexual life cycle with fusion of gametes. • DNA is replicated before meiosis so that all chromosomes consist of two sister chromatids. • The early stages of meiosis involve pairing of homologous chromosomes and crossing over followed by condensation. • Orientation of pairs of homologous chromosomes prior to separation is random. • Separation of pairs of homologous chromosomes in the first division of meiosis halves the chromosome number. **Applications and skills:** Skill: Drawing diagrams to show the stages of meiosis resulting in the formation of four haploid cells. **Guidance:** • Preparation of microscope slides showing meiosis is challenging and permanent slides should be available in case no cells in meiosis are visible in temporary mounts. • Drawings of the stages of meiosis do not need to include chiasmata. • The process of chiasmata formation need not be explained. **From Topic 3.4** **Understandings:** • The two alleles of each gene separate into different haploid daughter nuclei during meiosis.		

	From Topic 10.1 **Essential idea:** Meiosis leads to independent assortment of chromosomes and unique composition of alleles in daughter cells. **Understandings:** • Chromosomes replicate in interphase before meiosis. • Homologous chromosomes separate in meiosis I. • Sister chromatids separate in meiosis II. • **Aim 6:** Staining of lily anthers or other tissue containing germ-line cells and microscope examination to observe cells in meiosis are possible activities. -Review of Topic 1.6 Cell division -Prep for Topic 6.6 Hormones, homeostasis, and reproduction
Ch 13.4 Genetic Variation produced in sexual life cycles contributes to evolution.	**From Topic 3.3** **Essential idea:** Alleles segregate during meiosis allowing new combinations to be formed by the fusion of gametes. **Understandings:** • Crossing over and random orientation promotes genetic variation. • Fusion of gametes from different parents promotes genetic variation. **From Topic 10.1** **Essential idea:** Meiosis leads to independent assortment of chromosomes and unique composition of alleles in daughter cells. **Understandings:** • Crossing over is the exchange of DNA material between non-sister homologous chromatids. • Crossing over produces new combinations of alleles on the chromosomes of the haploid cells. • Chiasmata formation between non-sister chromatids can result in an exchange of alleles. • Independent assortment of genes is due to the random orientation of pairs of homologous chromosomes in meiosis I. **Applications and skills:** • Skill: Drawing diagrams to show chiasmata formed by crossing over. **Guidance:** • Diagrams of chiasmata should show sister chromatids still closely aligned, except at the point where crossing over occurred and a chiasma was formed. ***From Topic 10.3*** *(introduced in HL 1 but reinforced in HL 2)* ***Nature of science:*** *Looking for patterns, trends and discrepancies—patterns of chromosome number in some genera can be explained by speciation due to polyploidy (3.1).* -FYI: Please note that Random Fertilization is a POST Meiotic event! Yes it contributes to generic variation in the next generation of a species, but it is NOT an event that occurs DURNING meiosis!!! -Review for Topic 1.6 Cell division, Topic 11.4 Sexual reproduction