

Adult Basic Education
Science

Biology 3101B

Reproduction and Development

Curriculum Guide

Prerequisites: Biology 2101A
 Biology 2101C
 Biology 3101A

Credit Value: 1

Biology Concentration

Biology 1101
Biology 2101A
Biology 2101B
Biology 2101C
Biology 3101A
Biology 3101B
Biology 3101C

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To the Instructor

I. Introduction to Biology 3101B

Biology 3101B is the second of three courses (the others are Biology 3101A and Biology 3101C) that are equivalent to Biology 3201 in the current high school system. **This course is a pre-requisite for Biology 3101C.**

Biology 2101A, *The Cell*, Biology 2101C, *Maintaining Dynamic Equilibrium I*, and Biology 3101A, *Maintaining Dynamic Equilibrium II*, are **pre-requisites** for this course. However, before deciding to leave out any courses in the Biology concentration, you should ensure that you are aware of what courses students need to complete in order to meet the entrance requirements for the receiving post-secondary institution that they plan to attend.

Biology 3101B helps the student to understand the principles of how living organisms reproduce and develop at both the cellular and individual levels. The primary emphasis is placed on human systems. Students should begin to appreciate the complexity and importance of reproductive technologies and be able to discuss and analyze, from a variety of perspectives, the relative risks and benefits that these technologies create.

II. Curriculum Guides

Each new ABE Science course has a Curriculum Guide for the instructor and a Study Guide for the student. The Curriculum Guide includes the specific curriculum outcomes for the course. Suggestions for teaching, learning, and assessment are provided to support student achievement of the outcomes. Each course is divided into units. Each unit comprises a **two-page layout of four columns** as illustrated in the figure below. In some cases the four-column spread continues to the next two-page layout.

To the Instructor

Curriculum Guide Organization: The Two-Page, Four-Column Spread

Unit Number - Unit Title		Unit Number - Unit Title	
Outcomes	Notes for Teaching and Learning	Suggestions for Assessment	Resources
Specific curriculum outcomes for the unit.	Suggested activities, elaboration of outcomes, and background information.	Suggestions for assessing students' achievement of outcomes.	Authorized and recommended resources that address outcomes.

III. Study Guides

The Study Guide provides the student with the name of the text(s) required for the course and specifies the sections and pages that the student will need to refer to in order to complete the required work for the course. It guides the student through the course by assigning relevant reading and providing questions and/or assigning questions from the text or some other resource. Sometimes it also provides important points for students to note. (See the *To the Student* section of the Study Guide for a more detailed explanation of the use of the Study Guides.) The Study Guides are designed to give students some degree of independence in their work. Instructors should note, however, that there is much material in the Curriculum Guides in the *Notes for Teaching and Learning* and *Suggestions for Assessment* columns that is not included in the Study Guide and instructors will need to review this information and decide how to include it.

IV. Resources

Essential Resources

Text: *Biology; Bullard, Chetty, et al; McGraw-Hill Ryerson, 2003.*

McGraw-Hill Ryerson, Biology, Teacher's Resource.

To the Instructor

Recommended Resources

McGraw-Hill Ryerson, Biology, Teacher's Resource CD-ROM.

McGraw-Hill Ryerson, Biology 11/12 #D Science Animations.

McGraw-Hill Ryerson, Biology 11/12 Computerized Assessment Banks.

Department of Education web site:

www.gov.nl.ca/edu/science_ref/main.htm

Other Resources

Textbook web site:

<http://www.mcgrawhill.ca/school/booksites/biology/>

Center for Distance Learning and Innovation:

<http://www.cdli.ca/>

V. Recommended Evaluation

Written Notes	10%
Labs/Assignments	20%
Test(s)	20%
Final Exam (<i>entire course</i>)	<u>50%</u>
	100%

The overall pass mark for the course is 50%.

Reproduction and Development

Unit 1 - Cell Division

Outcomes

1.1 Describe mitosis and understand its importance.

1.1.1 Define cell cycle, mitosis and cytokinesis.

1.1.2 Explain the function of mitosis.

1.1.3 Describe the events of interphase, mitosis (prophase, metaphase, anaphase, telophase) and cytokinesis (the cell cycle).

1.1.4 Explain the importance of maintaining a constant number of chromosomes through the processes of cell and organism reproduction

Notes for Teaching and Learning

Students should be given the opportunity to observe and investigate the stages of the cell cycle and cytokinesis within both plant and animal cells through laboratory or computer simulations, diagrams, photographs, laser disc or time lapse video technology. Stages of mitosis can be observed using prepared slides of plant cells (onion root tips) or animal cells (whitefish blastula). Some comparisons between the process of mitosis in plant and animal cells may be demonstrated by careful examination of these prepared slides. Students may be asked to identify, sketch, and discuss what is occurring during each of the stages. Use of a video microscope display can assist the instructor in initially illustrating how to distinguish between cells in each of the different stages. Videos and laser disc clips are available to show mitosis and meiosis.

A short movie on mitosis can be found on the text's website at
<http://www.mcgrawhill.ca/school/booksites/biology/student+resources/index.php>.

Unit 1 - Cell Division

Suggestions for Assessment

Laboratory Activities

- Students could perform available laboratory activities to illustrate some aspects of the process of cell division. These may include examination of prepared microscope slides of chromosomes, preparation of squashes of *Drosophila* salivary glands, examination of prepared microscope slides of animal and plant cell mitosis and cytokinesis or growth of onion root tips and preparation of squashes to observe chromosomes. Assessment would depend on the nature and depth of the activities selected, ranging from the development of microscope diagrams to answering of questions to a more detailed discussion of procedures and results.

Paper and Pencil

- Students could develop a glossary of new terms they discover and will use during their study in this reproduction unit.
- Students should label diagrams of cells in the stages of mitosis. Instructors should make sure that students are able to label the diagrams correctly without referring to the text or any other resource.

Resources

McGraw-Hill Ryerson Biology, pp. 460-465.

McGraw-Hill Ryerson Biology, pages 392-401.

McGraw-Hill Ryerson Biology, Teacher's Resource.

McGraw-Hill Ryerson Biology, Teacher's Resource CD-ROM.

Biology 11/12 Computerized Assessment Banks.

Web site for mitosis movie: www.mcgrawhill.ca/school/booksites/biology/student+resources/index.php.

Diagram, "Stages of Mitosis", Appendix A.

www.gov.nl.ca/edu/science/ref/main.htm

<http://www.mcgrawhill.ca/school/booksites/biology/>

Unit 1 - Cell Division

Outcomes

1.2 Use instruments effectively and accurately for collecting data on the cell cycle.

1.2.1 Observe, identify and describe (using prepared slides of plant and animal cells) the events of the cell cycle. Include:

- (i) growth
- (ii) cytokinesis
- (iii) chromosome behaviour

1.3 Describe meiosis.

1.3.1 Define meiosis.

1.3.2 Describe the events of meiosis (reduction-division).

1.3.3 Explain the necessity of chromosome reduction during the production of sex cells.

1.3.4 Describe the crossing-over process and explain its role in helping randomize the gene combinations for sex cells.

Notes for Teaching and Learning

Outcome 1.2 is addressed by completing the lab, *“Observing the Cell Cycle in Plant and Animal Cells”*.

Teachers should note that chromosomal disorders associated with crossing-over are done in detail in the genetics unit.

A short movie on mitosis can be found on the text's website at

<http://www.mcgrawhill.ca/school/booksites/biology/student+resources/index.php>

Unit 1 - Cell Division

Suggestions for Assessment

Laboratory

- Students must complete Investigation 12.A, “Observing the Cell Cycle in Plant and Animal Cells”. They should submit the *Post Lab Questions* and *Conclude and Apply* section for evaluation.

Performance

- Students could make a model and demonstrate the events of meiosis. It should include homologous chromosomes, dominant and recessive alleles. Students should illustrate the randomness of allele assortment during meiosis. Sample materials that may be used include pipe cleaners, Popsicle sticks, Velcro TM, toothpicks, push pins, etc.

Paper and Pencil

- Students should label the diagram of the stages of meiosis. Instructors should make sure that students are able to label the diagram correctly without referring to the text or any other resource.
- Students should complete relevant Section Review and Chapter Review questions.
- Students should add to the glossary of terms.

Resources

Core Lab:

Investigation 14.A, “Observing the Cell Cycle in Plant and Animal Cells”, pages 466 - 467.

MGH Biology, pp. 470-475.

Diagram, “Stages of Meiosis”, Appendix A.

Unit 1 - Cell Division

Outcomes

1.4 Analyze and describe the function of spermatogenesis and oogenesis.

1.4.1 Examine the processes of spermatogenesis and oogenesis.

1.4.2 Explain why there is only one functional egg produced during oogenesis.

1.4.3 Describe and compare the structure of sperm and egg cells.

Include:

- (i) relative sizes
- (ii) energy reserves
- (iii) mitochondria
- (iv) numbers produced
- (v) motility
- (vi) enzyme cap (acrosome)

Notes for Teaching and Learning

To highlight the differences between spermatogenesis and oogenesis, students could develop a table or chart which summarizes gamete formation.

Students could summarize the comparison of sperm and egg in a table.

Unit 1 - Cell Division

Suggestions for Assessment

Paper and Pencil

- Students should complete relevant Section Review and Chapter Review questions.
- Students should add to the glossary of terms.

Testing

- This is the end of the section of the course covering cell division. Instructors may choose to give a test to cover Unit 1. Testing should include some of the diagrams that students have studied. The mark for this test should be used as part of the evaluation for the course.

Resources

MGH Biology, pp. 477-478.

*Biology 11/12
Computerized Assessment Banks.*

Unit 2- Reproductive Systems: Strategies

Outcomes

2.1 Analyze natural reproductive strategies to interpret and explain their structure and dynamics.

2.1.1 Distinguish between asexual and sexual reproduction.

2.1.2 Define various types of asexual reproduction.
Include:

- (i) budding
- (ii) binary fission
- (iii) spore production
- (iv) fragmentation

2.2 Describe mitosis and meiosis within plant reproduction.

2.2.1 Observe, identify and give the function of the basic structures of sexual reproduction in angiosperms (flowering plants). Include:

- (i) pistil
- (ii) stamen
- (iii) pollen
- (iv) ovules
- (v) seed
- (vi) fruit

2.2.2 Describe the process of sexual reproduction in flowering plants.

Notes for Teaching and Learning

Investigation of the range of reproductive strategies found within the plant and animal kingdoms serves to reinforce the concept of biodiversity. This information can be presented to the student in the form of charts, tables or diagrams.

See Appendix A, Table 1: *Modes of Reproduction*.

Outcome 2.2.1 is addressed by completing Investigation 6.A, “*Reproductive Structures in Flowers*”.

Students can observe the male and female reproductive structures of angiosperms through the use of models, charts, computer simulations or the dissection of a flower within a laboratory setting.

Unit 2- Reproductive Systems: Strategies

Suggestions for Assessment

Laboratory Activities

- Students could observe the examples of the reproductive processes provided within the laboratory. These may include prepared slides or wet mounts of budding in yeast, budding in hydra, or wet mounts of mold spores. Assessment would depend on the nature of the activities selected and could range from the development of microscope diagrams to the answering of questions.
- Students could perform the available laboratory activities to illustrate some aspects of the reproductive process. These may include examination of prepared microscope slides of ovaries and testes (egg and sperm cells), examination of the reproductive parts of a flower, comparison of a monocot and dicot seed and/or examination of a composite flower (daisy, dandelion). Assessment would depend on the nature of the activities selected, ranging from the development of microscope diagrams to the answering of questions.
- Students could dissect a flower from the lily family. They should draw a picture of each part, label it, and reconstruct the flower using individually drawn sketches.

Pencil and Paper

- Students could add to the glossary of terms.
- Students should label diagrams of the reproductive structures of flowering plants. Instructors should make sure that students are able to label the diagram correctly without referring to the text or any other resource.

Resources

Table #1: "Modes of Reproduction", Appendix A.

MGH Biology, pp.134, 154, 155, 157, 166, 186.

MGH Biology, pp. 175-181.

Core Lab:
Investigation 6.A, "Reproductive Structures in Flowers".

Diagram, Reproductive Structures of a Flowering Plant", Appendix A.

Unit 3 - Reproductive Systems: Regulation

Outcomes

3.1 Identify the structures of the human male reproductive system and describe their functions.

Include:

- (i) testis
- (ii) scrotum
- (iii) seminiferous tubules
- (iv) epididymis
- (v) sperm duct (vas deferens)
- (vi) Cowper's (bulbourethral) gland
- (vii) seminal vesicle
- (viii) prostate
- (ix) urethra

3.2 Explain the human male reproductive cycle.

3.2.1 Identify and state the functions of the principal reproductive hormones of the human male. Include:

- (i) inhibin
- (ii) follicle stimulating hormone (FSH)
- (iii) luteinizing hormone (LH)
- (iv) testosterone

3.2.2 Explain the function and interactions among these hormones in maintaining the male reproductive system.

Notes for Teaching and Learning

Students should be provided with the opportunity to observe and discuss the function of the principal features of the male reproductive system using models, dissections or computer simulations and to identify and label the major structures from drawings or photos of that organ system.

Students can analyze sample data on blood hormone levels and physiological events and infer the roles of the male sex hormones.

Students could examine the interaction of these hormones in the form of a negative feedback loop.

Unit 3 - Reproductive Systems: Regulation

Suggestions for Assessment

Paper and Pencil

- Students should trace the path of a sperm cell from where it is formed to the point of fertilization.
- Students should label diagrams of the male reproductive system. Instructors should make sure that students are able to label the diagram correctly without referring to the text or any other resource.

Resources

MGH Biology, pp. 486-489.

Diagram, “Male Reproductive System”, Appendix A.

Unit 3 - Reproductive Systems: Regulation

Outcomes

3.1 Identify the structures of the human female reproductive system and describe their functions.

Include:

- (i) ovary
- (ii) follicles
- (iii) oviduct (fallopian tube)
- (iv) fimbriae
- (v) uterus
- (vi) endometrium
- (vii) cervix
- (viii) vagina

3.2 Explain the human female reproductive cycle.

3.2.1 Identify and state the functions of the principal reproductive hormones of the human female. Include:

- (i) estrogen
- (ii) progesterone
- (iii) luteinizing hormone (LH)
- (iv) follicle stimulating hormone (FSH)

3.2.2 Explain the function and interactions among these hormones in the menstrual cycle.

Notes for Teaching and Learning

Students should be provided with the opportunity to observe and discuss the function of the principal features of the female reproductive system using models, dissections or computer simulations, and to identify and label the major structures from drawings or photos of that organ system.

Students can analyze sample data on blood hormone levels and the physiological events of a single menstrual cycle, and infer the role of the female sex hormones.

Students could examine the interaction of these hormones in the form of a negative feedback loop.

Unit 3 - Reproductive Systems: Regulation

Suggestions for Assessment

Paper and Pencil

- Students could use a case study to analyze data on blood hormone levels and physiological events during a female menstrual cycle. They should investigate how the cycle is regulated using positive and negative feedback and the roles of pituitary and ovarian hormones. Assessment should be based upon the logical analysis of data and conclusions drawn.
- Students could select a suitable article from a publication, electronic, or media source for critique and analysis. This could be integrated with the Language Arts program.
- Students should label diagrams of the female reproductive system. Instructors should make sure that students are able to label the diagram correctly without referring to the text or any other resource.

Resources

MGH Biology, pp. 490-492.

Diagram, “Female Reproductive System”, Appendix A.

Unit 3 - Reproductive Systems: Regulation

Outcomes

3.5 Research and describe the potential health risks on individuals and society associated with exposure to sexually transmitted infections. Include:

- (i) HIV and AIDS
- (ii) chlamydia
- (iii) hepatitis B
- (iv) genital herpes
- (v) syphilis
- (vi) gonorrhea

Notes for Teaching and Learning

HIV transmission or other STI's can be simulated with the use of a base (sodium hydroxide) and an indicator (phenolphthalein). A class set of test tubes of water containing one test tube with diluted base can be arranged. Students can swap "fluids" and the transmission can be detected later using the indicator.

Unit 3 - Reproductive Systems: Regulation

Suggestions for Assessment

Presentation

- When teaching to a group, students could be introduced to individuals knowledgeable in a variety of aspects of human reproductive health and sexually transmitted infections by using community resources such as physicians or available organizations (Sexual Health Centres). Students should research and prepare questions related to the topic being presented by the guest speaker. With the instructor, students should review and revise these questions, and select those to be asked during the presentation. Subsequently, students may be asked to prepare a brief summary of the presentation or of the answer to their question. Assessment could be based on a student summary of the guest's talk or answers provided to one of their questions.

Paper and Pencil

- Students should complete relevant Section Review and Chapter Review questions.
- Students should add to the glossary of terms.

Assignment

- Students must complete Assignment 1, “Sexually Transmitted Infections”.

NOTE:

The assignment should be marked and the mark used as part of the evaluation for the course. The content covered in the assignment should not be tested.

Resources

MGH Biology, pp. 496-499.

Assignment 1, “Sexually Transmitted Infections”, Appendix B.

Unit 4 - Reproductive Technologies

Outcomes

4.1 Evaluate the design of birth control technologies and the way they function. Include:

- (i) abstinence
- (ii) birth control pills
- (iii) NorplantTM (implant)
- (iv) morning after pill
- (v) Depo-ProveraTM
- (vi) (needle)
- (vii) IUD (interuterine device)
- (viii) tubal ligation
- (ix) diaphragm
- (x) spermacidal jellies and foams
- (xi) condom
- (xii) vasectomy
- (xiii) rhythm method

Notes for Teaching and Learning

Students should evaluate the relative effectiveness of various methods of contraception and perform a risk/benefit analysis on the implementation of these for various segments of the population.

Teachers may wish to organize the information according to mode of operation:

- a) Barrier Methods (condom, diaphragm, jellies and foams, IUD)
- b) Hormonal Methods (birth control pill, NorplantTM , morning after pill, Depo-ProveraTM)
- c) Surgical Methods (tubal ligation, vasectomy)
- d) Other (rhythm method, abstinence)

Unit 4 - Reproductive Technologies

Suggestions for Assessment

Paper and Pencil

- Students could research and evaluate types of contraception that are being promoted for the use of population control within developing countries. Assessment should be based on accuracy and relevancy of information gathered and completeness of research.
- Students could use a case study to analyze moral and ethical implications of new reproductive technologies.
- Students could investigate a variety of chemical and physical methods of contraception. They will explain how these contraceptives work, their effectiveness in prevention of pregnancy and STI's, and societal implications of their use from various perspectives.
- Students could add to the glossary of terms.
- Students should complete relevant Section Review and Chapter Review questions.

Assignment

- Students must complete Assignment 2, “Reproductive Technologies”.

NOTE:

The assignment should be marked and the mark used as part of the evaluation for the course. The content covered in the assignment should not be tested.

Resources

MGH Biology, pp. 501-503

Assignment 2, “Reproductive Technologies”, Appendix B.

Unit 5 - Embryonic Differentiation and Development

Outcomes

5.1 Explain the processes of fertilization and development in human reproduction.

5.1.1 Trace the journey of sperm and egg from their origin until fertilization and implantation.

5.1.2 Explain how fraternal and identical offspring are produced.

5.1.3 Describe the following basic stages of embryonic development:

(i) cleavage

(ii) morula

(iii) blastocyst (blastula)

(iv) gastrula

(v) germ layers

(vi) implantation

(vii) differentiation

Notes for Teaching and Learning

Students should recognize the distinction between the fertilization and initial embryonic development that produce identical and fraternal twins, and discuss the mechanism in which multiple births (triplet, quadruplets) may result naturally. Students could consider the question, "Why are fraternal twins no more alike than any set of brothers or sisters?"

Students should have the opportunity to observe the stages of embryo development through the use of preserved materials, prepared slides (cleavage of sea stars), audiovisual presentations or computer simulations, and extrapolate these events to the development of the human fetus. In addition, there are good web sites available on the Internet that illustrate the process of development.

A short movie on Embryonic Development can be found on the text's website at
<http://www.mcgrawhill.ca/school/booksites/biology/student+resources/index.php>

Unit 5 - Embryonic Differentiation and Development

Suggestions for Assessment

Laboratory Activities

- Students could perform the laboratory activities available on the process of development. These might include microscopic examination of prepared slides of stages of cleavage of sea stars or sea urchin development, observation of embryo development in the frog utilizing a culture of frog eggs, or observation of microslides of frog or chick embryo development. Assessment would depend on the nature and depth of the activities selected, ranging from the development of microscope diagrams, answering of questions, to a more detailed discussion.

Resources

MGH Biology, pp. 506-509.

Web site for movie:

<http://www.mcgrawhill.ca/school/book/sites/biology/student+resources/index.php>

Unit 5 - Embryonic Differentiation and Development

Outcomes

5.2 Explain the processes of development and birth in human reproduction.

5.2.1 Describe the roles of the placenta and umbilical cord during pregnancy.

5.2.2 Examine the effects of teratogens on the development of the embryo. Include:

(i) cigarette smoke

(ii) alcohol

5.2.3 Describe the process of childbirth. Include:

(i) dilation stage

(ii) expulsion stage

(iii) placental stage

Notes for Teaching and Learning

The societal impact of chemical and drug abuse on fetal development (alcohol, cocaine, cigarettes) may be investigated and discussed.

Prescription drugs, such as thalidamide, have positive effects on adults and children for the treatment of certain medical conditions. These drugs taken during pregnancy, however, may have serious negative effects on fetal development. Thalidamide, used in the 1950's as a treatment for morning sickness, is one example of this.

Suggestions for Assessment

Resources

Unit 5 - Embryonic Differentiation and Development

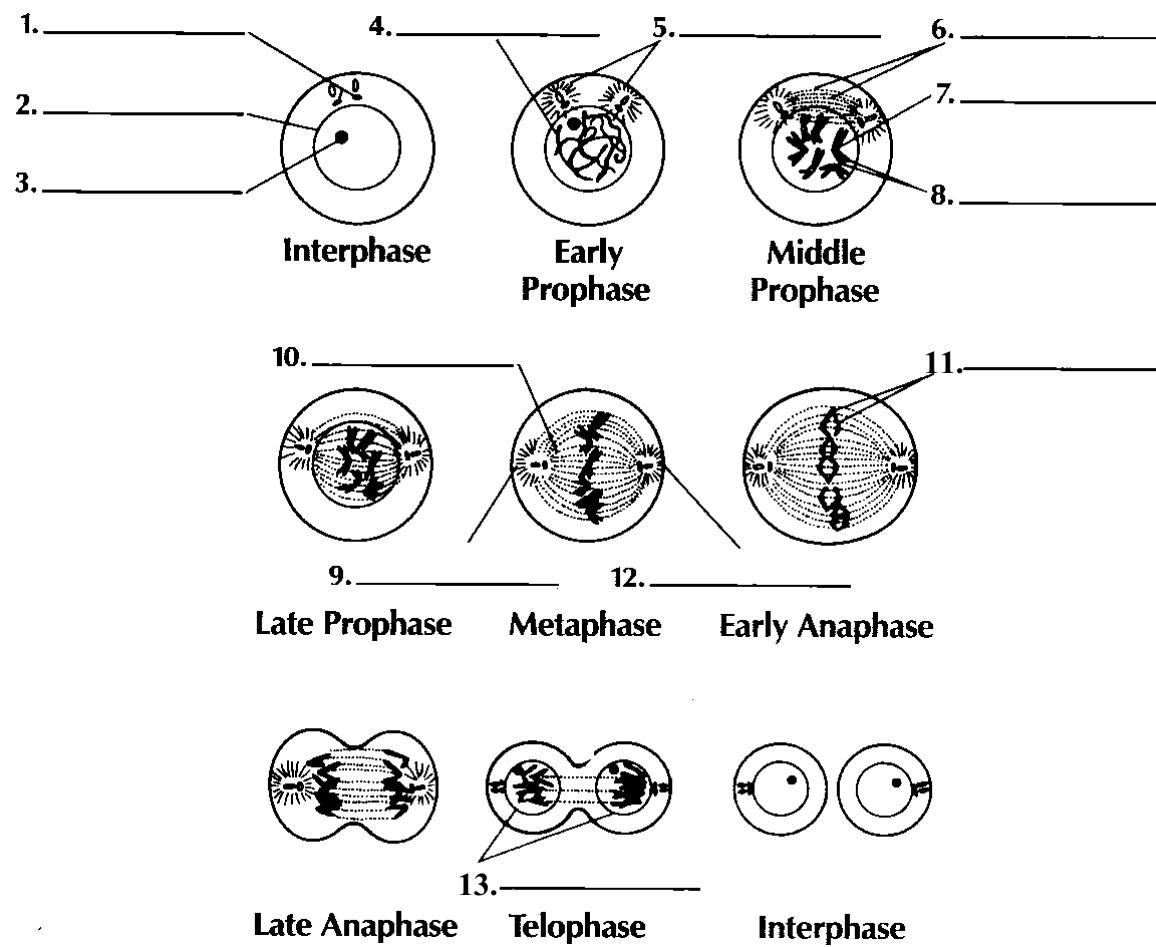
Paper and Pencil

- Students could research and present the effects of different types of teratogens.
- Students should add to the vocabulary list for this part of the course.
- Students should complete relevant Section Review and Chapter Review questions.

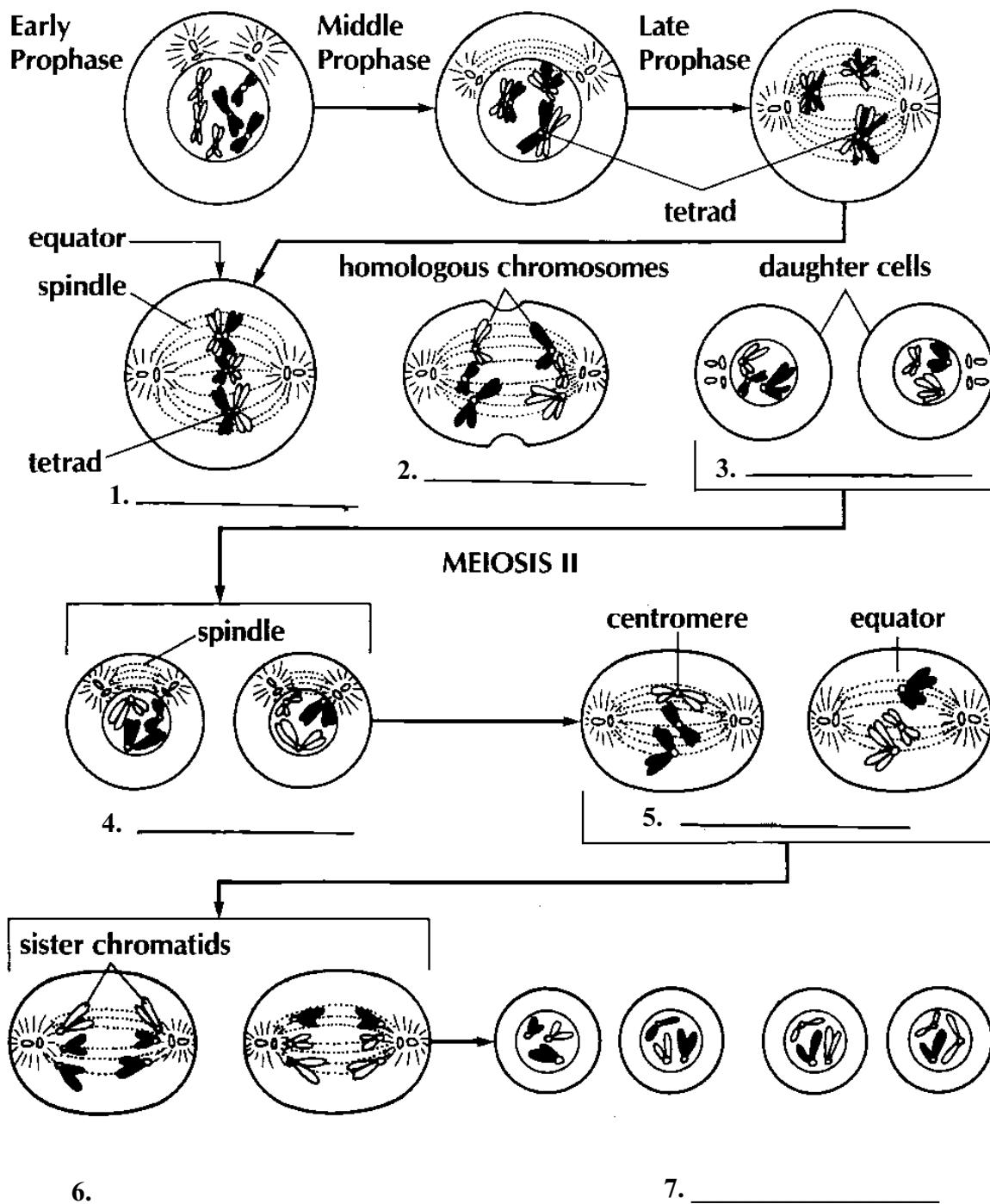
MGH Biology, pp. 510-513.

Appendix A

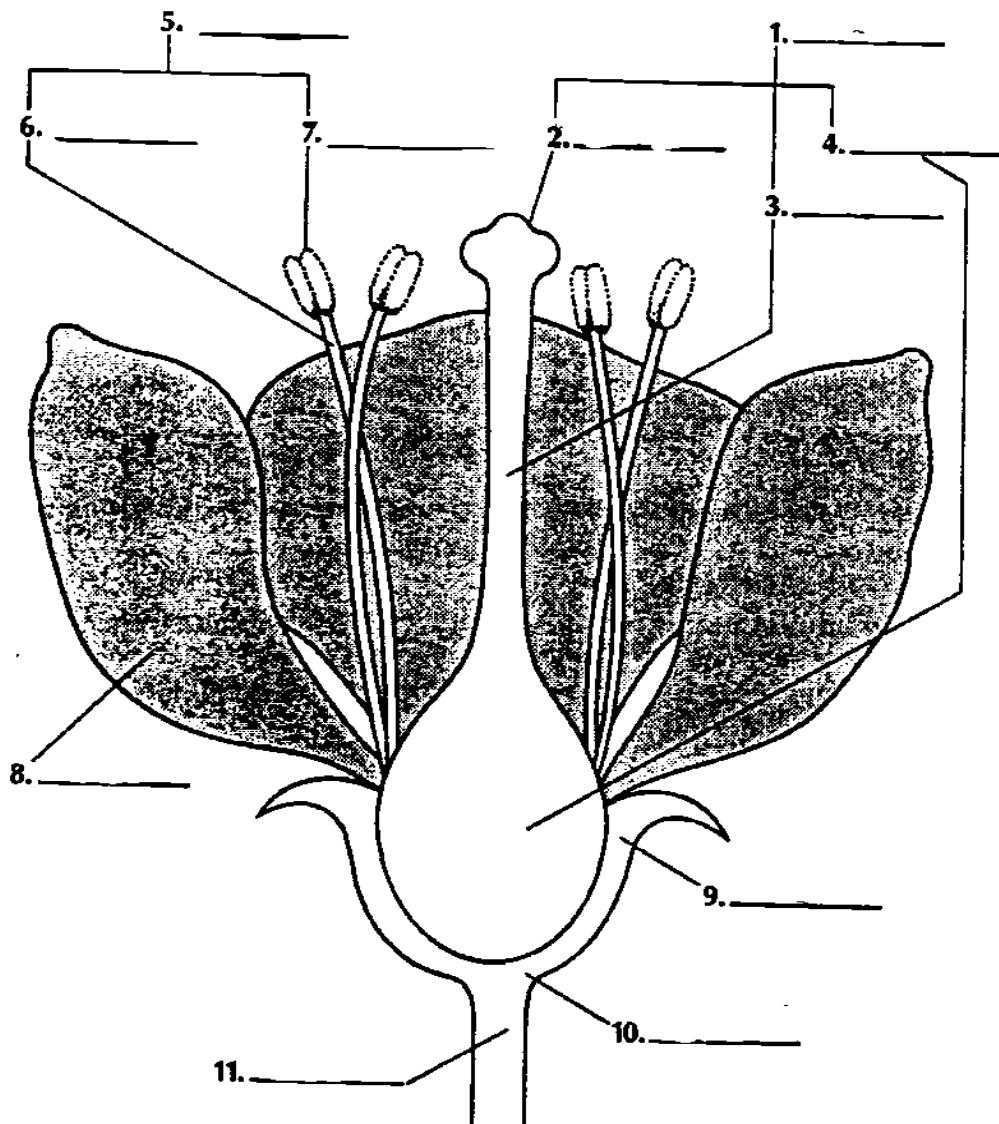
Diagrams



Interphase and Mitotic Cell Division in Animal Cells



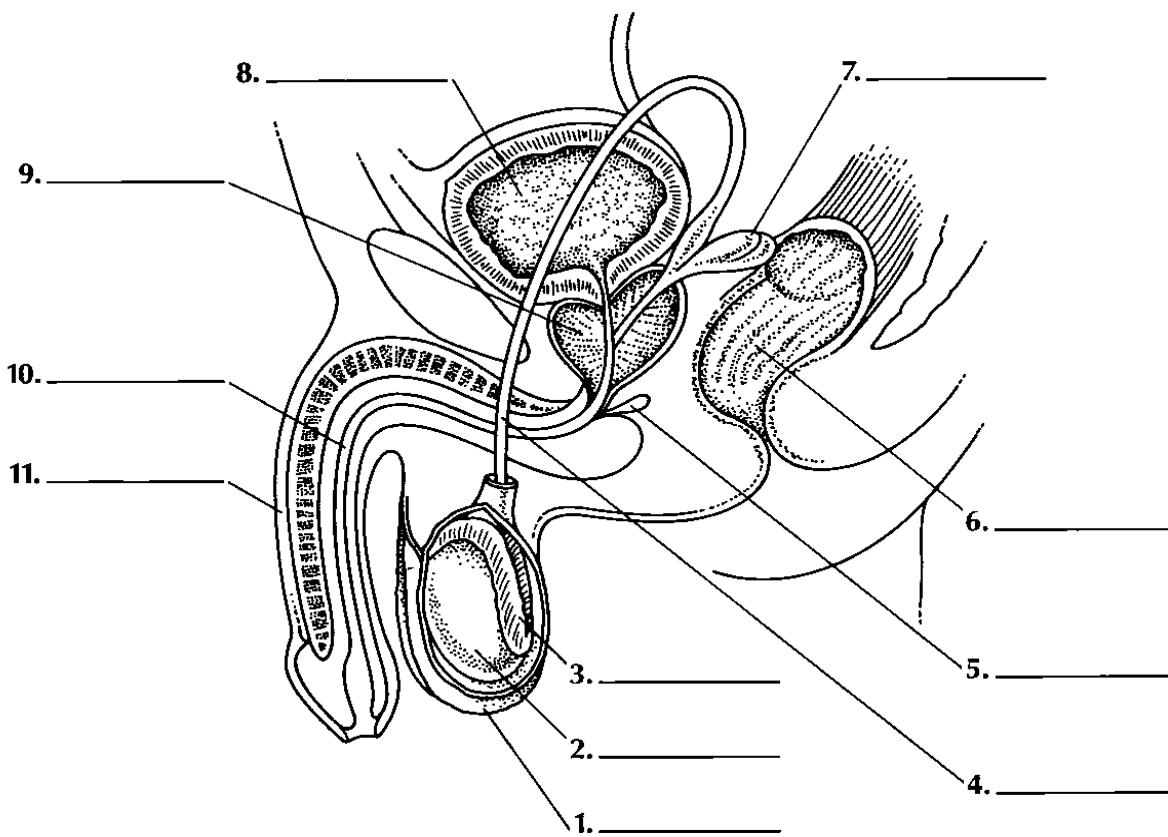
Stages of Meiosis



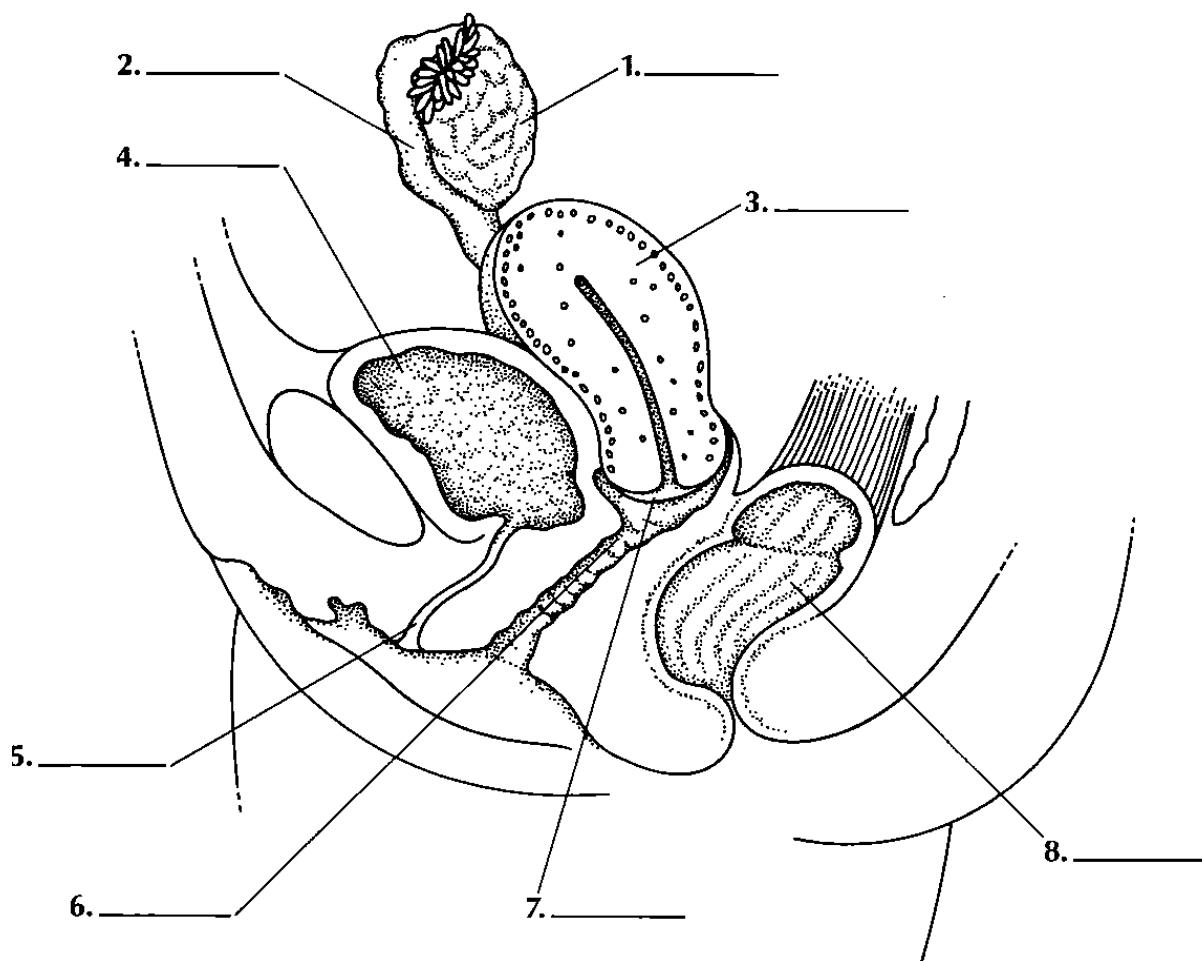
Reproductive Structures in a Flowering Plant

Table 1
Modes of Reproduction

	Types	Description	Representative Example
Asexual <i>One Parent cell divides by mitosis to produce 2 identical cells which are clones of the parent.</i>	Budding	An outgrowth on the parent organism develops into a new organism that separates from the parent.	Ultimately, yeast, and hydra
	Binary Fission	Through mitotic cell division copies of the parent are made the parent “splits” to create new cells.	Bacteria
	Sport Production	Through mitotic cell division copies of the parent are made the parent “splits” to create offspring.	Fungi eg. Rhizopus
	Fragmentation	Pieces of the parent organism break off and are dispersed. Each section is able to form a new organism.	House Plants grown from cuttings
	Parthenogenesis	Through mitotic cell division offspring are produced from unfertilized eggs.	Some insects eg. Balsam Wolly aphid
Sexual	<i>New offspring are created as a result of the fusion of egg and sperm nuclei. The offspring resemble but are not identical to the parents.</i>		

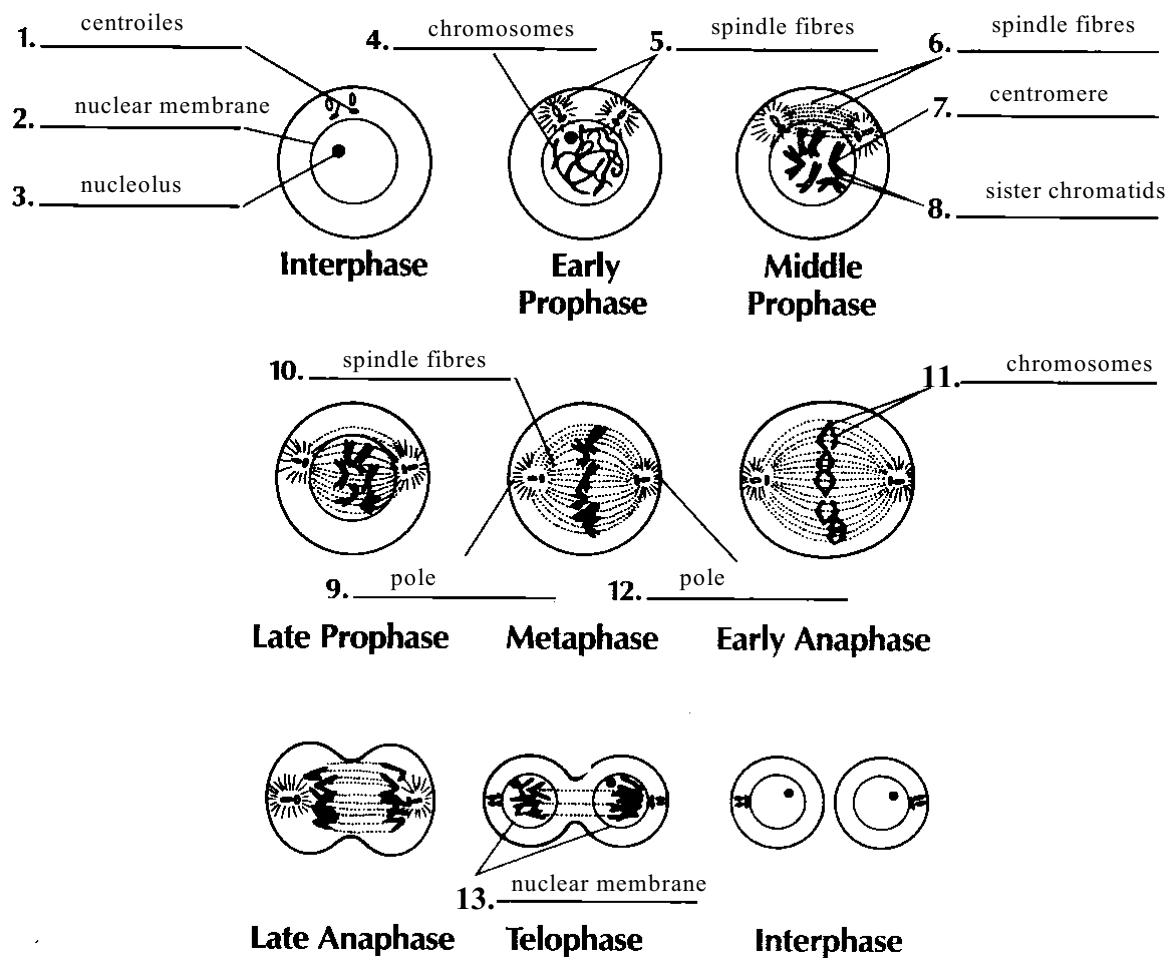


Reproductive System of Human Male

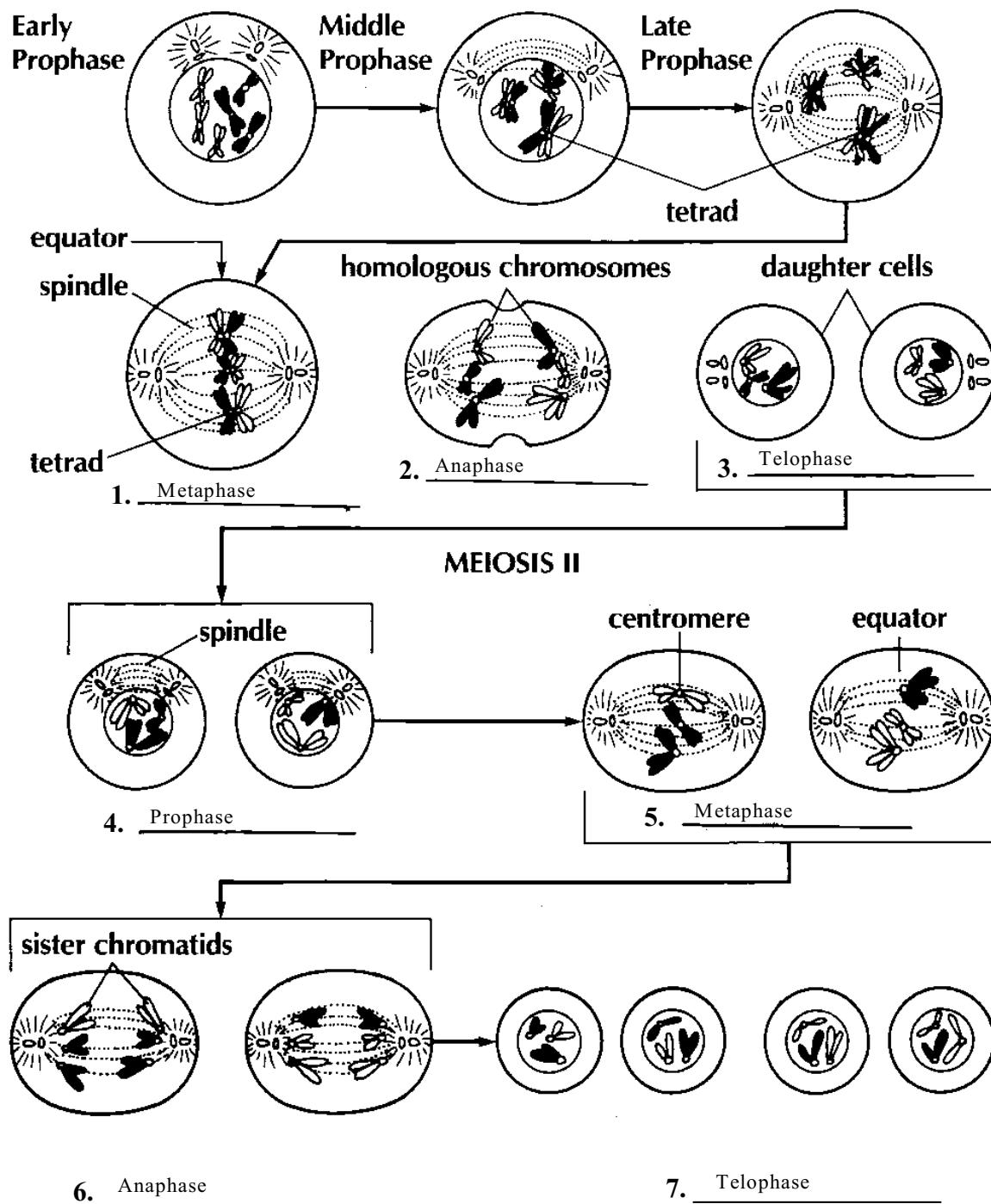


Reproductive System of Human Female

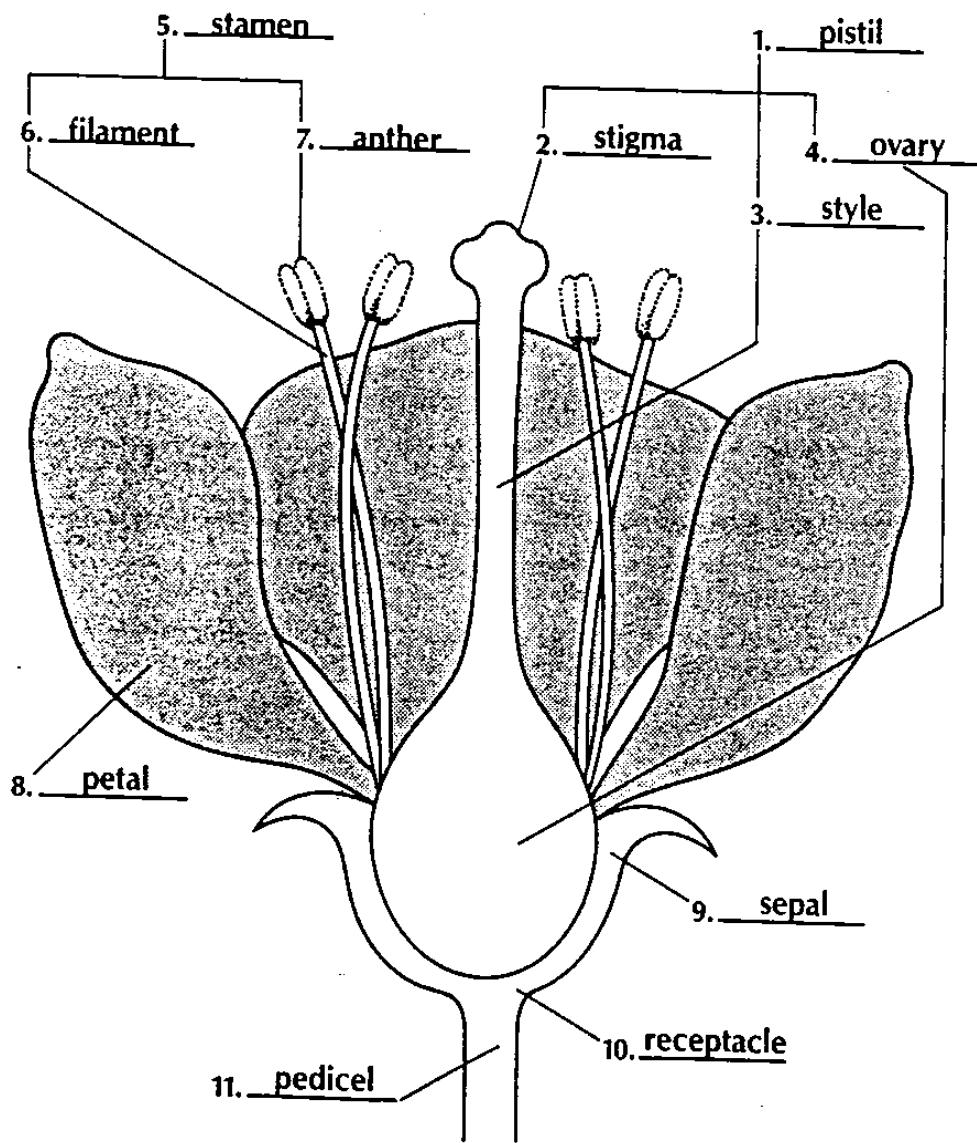
ANSWER SHEETS



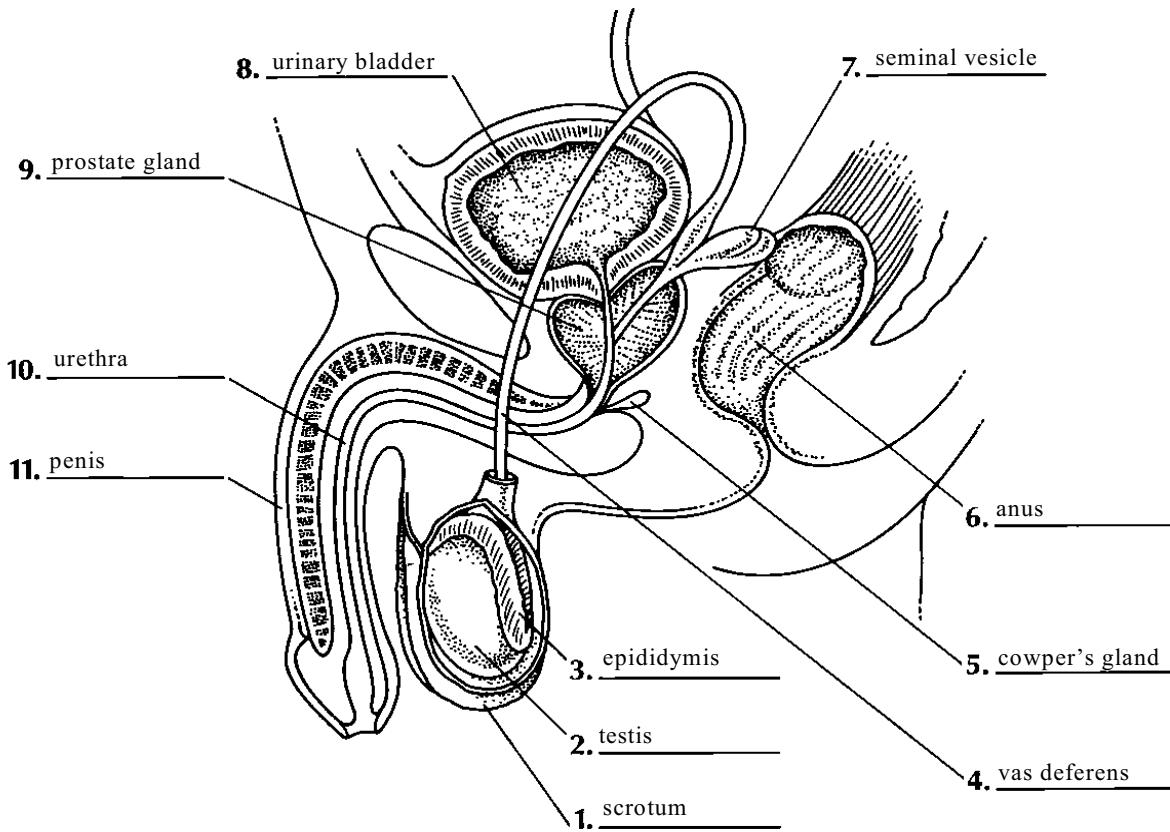
Interphase and Mitotic Cell Division in Animal Cells - ANSWER SHEET



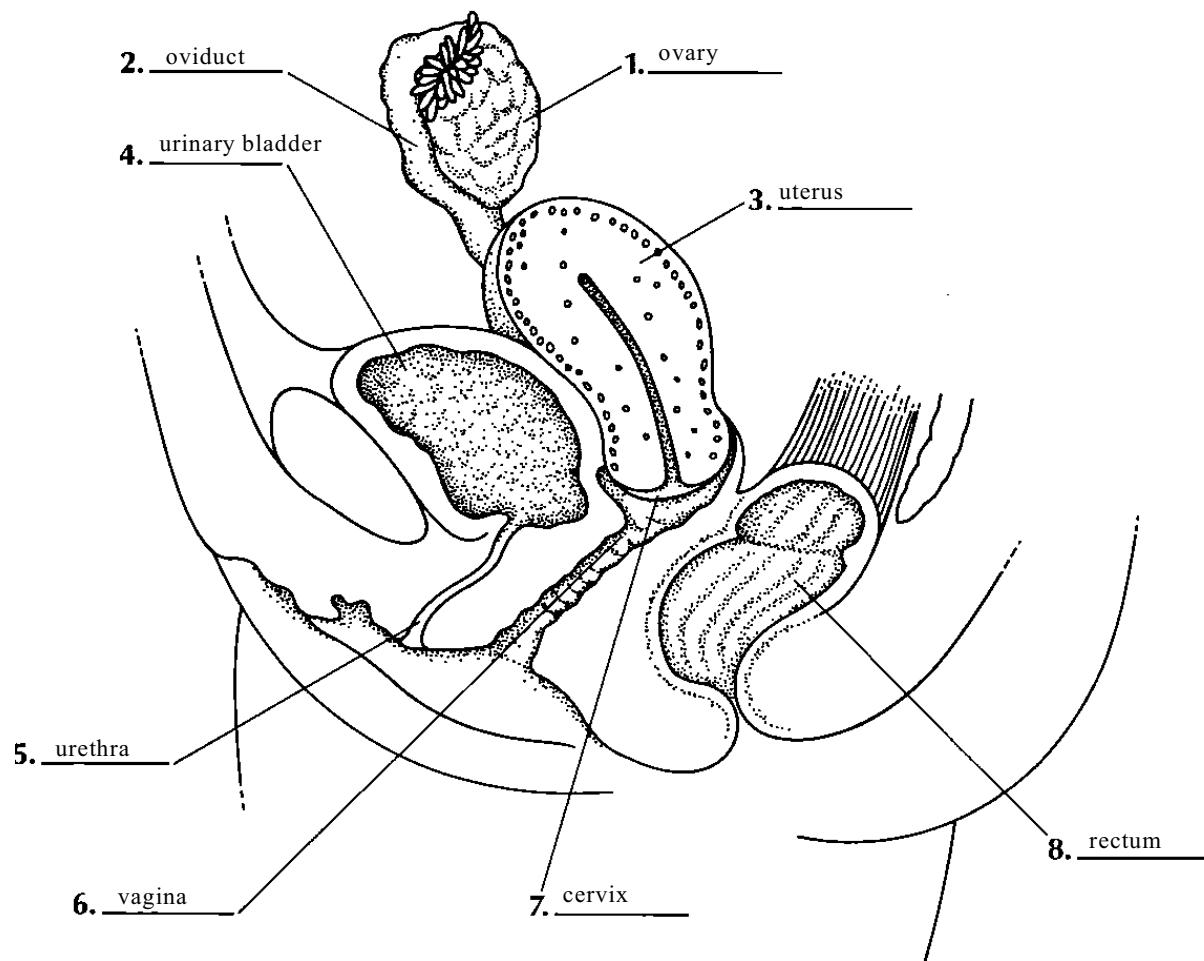
Stages of Meiosis



Reproductive Structures in a Flowering Plant



Reproductive System of Human Male - ANSWER SHEET



Reproductive System of Human Female - ANSWER SHEET

Appendix B

Assignments

Assignment 1

Sexually Transmitted Infections

1. What does STI stand for?

2. Describe the cause, symptoms and treatments for each of the following STI's:
 - (i) HIV and AIDS
 - (ii) chlamydia
 - (iii) hepatitis B
 - (iv) genital herpes
 - (v) syphilis
 - (vi) gonorrhea

Assignment 2

Reproductive Technologies

1. Define contraception.
2. Give a brief description of each of the methods of birth control listed below and explain how it works:
 - (i) abstinence
 - (ii) birth control pills
 - (iii) Norplant™ (implant)
 - (iv) morning after pill
 - (v) Depo-Provera™ (needle)
 - (vi) IUD (intrauterine device)
 - (vii) tubal ligation
 - (viii) diaphragm
 - (ix) spermacidal jellies and foams
 - (x) condom
 - (xi) vasectomy
 - (xii) rhythm method

