SENIOR HIGH SCHOOL CURRICULUM GUIDE

for

BIOLOGY 20

BIOLOGY 32

BIOLOGY 30

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DEPARTMENT OF EDUCATION

EDMONTON, ALBERTA

SEPTEMBER, 1965

SENIOR HIGH SCHOOL CURRICULUM GUIDE

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DEPARTMENT OF EDUCATION

EDMONTON, ALBERTA

SEPTEMBER, 1965

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CONTENTS

	PAGE
Philosophy and objectives of biology courses	4
Specific objectives of Biology 20	5
Biology 20 texts, references and suggested time schedule	5
Biology 20 course outline	6
Specific objectives of Biology 32. Texts, references and Suggested Time Schedule	10
Biology 32 course outline	11
Specific objectives of Biology 30, Texts and references	16
Suggested Time Schedule	17
Biology 30 courses outline	17
Suggestions regarding field trips	19
Suggested reference books for biology library	21
Biology equipment and supplies list	26

PHILOSOPHY AND OBJECTIVES IN RELATION TO BIOLOGY COURSES

The understanding of biological principles and processes is paramount. While principles cannot be developed in the absence of supporting facts, the memorization of technical detail is unwarranted. However, mastery of a limited number of technical terms is essential for precise communication. Principles become more meaningful when applied to specific problems. The teaching of structure and function should be correlated throughout the course.

The courses are designed to familiarize the student with his immediate biological world. Every student should be given opportunity to participate in field trips, and adequate facilities must be provided for first-hand laboratory study.

The courses should ensure a positive realization of the interdependence of living organisms and the importance of conservation.

LABORATORY WORK IN BIOLOGY

Laboratory work is a vital part of the high school biology program. In order that students obtain maximum value from the laboratory experiences, the designated laboratory exercises should be done concurrently with the text material. It is expected that at least one period per week be devoted to laboratory work. It is strongly recommended that living specimens be utilized for laboratory work as the occasion demands. Living plants and animals suitably maintained, are valuable in creating an appropriate environment for teaching biology.

BIOLOGY 20

SPECIFIC OBJECTIVES OF THE BIOLOGY 20 COURSE

1. The systematic study of the structure and functions of representatives of each of the major phyla of organisms.
2. The handling of the microscope and of other standard laboratory equipment.
3. The accurate observation of biological phenomena in the field and in the laboratory, and the precise recording of data.
4. The mastery of skills needed to collect and maintain living specimens, to identify them with the use of keys, and to preserve them for future study.
5. The study of the principles of heredity, and of the history of life on the earth.

TEXTS AND TEACHER REFERENCES

Texts:

Modern Biology, 1961 Edition, Moon, Otto and Towle.

Modern Biology, 1963 Edition, Moon, Otto and Towle.*

Laboratory Exercises for Introductory Biology, Department of Education.

Teacher References:

A Sourcebook for the Biological Sciences, Morholt, Brandwein and Joseph.

Points of View on Theory of Evolution, Supplement to *Elements of Biology*, Weise.

Principles of Biology, Buffaloe.

Modern Biology, Moon, Mann and Otto (Canadian Edition).

Renewable Natural Resources of Alberta, Department of Education.

* The 1963 edition is recommended when systems purchase new stock.

TIME SCHEDULE

The following time schedule is suggested. It is anticipated of schools that teachers will depart from this schedule as is appropriate to meet the needs and interests of their particular classes.

Unit	Suggested Time
1	6 Weeks
2	2 Weeks
3	5 Weeks
4	7 Weeks
5	11 Weeks
6	4 Weeks
	<hr/> 35 Weeks

COURSE OUTLINE — BIOLOGY 20

All references are to the text book, 1963 edition, unless otherwise indicated.

Unit 1: Introduction (6 Weeks)

Topic	Reference	Lab.	Time
1. Science of Life	Chapter 1	1, 2 and 3	} 1 Week
Develop from laboratory exercises:			
Scientific attitudes			
The microscope			
Modern compound microscope			
What biology can do for you			
2. Fundamental Properties of Life	Chapter 2		
3. Chemical Basis of Life	Chapter 3		1 Week
4. Structural Basis of Life	Chapter 4	4 and 5	1 Week
5. Balance in the World of Life	Chapter 6		½ Week
6. Vital Factors of the Environment	Chapter 7		1 Week
Omit "Plant Formations of the United States" page 71. Include a survey of the Alberta situation based on the appropriate sections of <i>Renewable Natural Resources of Alberta</i> .			
7. Functional Basis of Life	Chapter 5		½ Week
8. Basis of Heredity	Chapter 49		½ Week
9. Classification of Organisms	Chapter 8		½ Week
			<hr/> 6 Weeks

Stress should be placed on the "modern" system as outlined on page 83. This system should be adhered to in presenting typical organisms in the succeeding chapters.

Unit 2: Survey of Monera (2 Weeks)

Topic	Reference	Lab.	Time
1. Phylum Schizophyta	Chapter 10, p. 83	6	1 Week
2. Phylum Cyanophyta	Pp. 91 - 95	7	1 Week
			<hr/> 2 Weeks

Unit 3: Survey of Protista (5 Weeks)

Topic	Reference	Lab.	Time
1. Phylum Chlorophyta	Pp. 95 - 100, p. 83	8 and 9	} 1 Week
2. Phylum Chrysophyta	Pp. 101 - 102		
3. Phylum Mycophyta slime mold bread mold lichen yeast one of: rust, smut, mildew, mushroom	Chapter 11	10 and 11	1½ Weeks
4. Phylum Mastigophora } Phylum Euglenophyta } Euglena	Chapter 20	12	½ Week
5. Phylum Sarcodina — Amoeba	Chapter 20	13	} 1½ Weeks
6. Phylum Ciliata — Paramecium	Chapter 20	14	
7. Phylum Sporozoa — Plasmodium	Chapter 20		½ Week
			5 Weeks

Unit 4: Survey of Plantae (Metaphyta) (7 Weeks)

Topic	Reference	Lab.	Time
1. Phylum Bryophyta (emphasize life cycle of moss)	Pp. 127 - 130	15	1 Week
2. Phylum Tracheophyta			
(a) Class Filicineae	Pp. 130 - 132	16	½ Week
(b) Class Gymnospermae	Pp. 139 - 141		½ Week
(c) Class Angiospermae			
(1) General characteristics	Pp. 141 - 145		½ Week
(2) Root and absorption	Chapter 14 and 15	17, 18 and 19	1 Week
(3) Stem	Chapter 16	20 and 21	1 Week
(4) Leaf	Chapter 17	22 and 23	1 Week
<i>Omit chlorophyll types, p. 187 and pp. 195-198</i>			
(5) Flower	Chapter 18 Buffaloe: PRINCIPLES OF BIOLOGY Pp. 220 - 227	24	1 Week
(6) Seeds	Pp. 216 - 219	25	½ Week
			7 Weeks

Unit 5: Survey of Animalia (Metazoa) (11 Weeks)

Emphasis should be placed upon the increasing complexity of structure, the development of systems and their integration to form complex organisms. Students should understand why the increasing size of organisms brings about a need for various systems.

Topic	Reference	Lab.	Time
General features	Pp. 241 - 242		} ½ Week
1. Phylum Porifera	Pp. 242 - 245, 715		
2. Phylum Coelenterata	Pp. 246 - 249, 715		1 Week
(a) Hydra		26	
(b) Aurelia — life cycle			

3. Phylum Platyhelminthes	Pp. 253 - 256, 716	27	1 Week
(a) Planarians — general structure			
(b) Flukes — life cycle			
(c) Tapeworms — structure and life cycle			
4. Phylum Nemathelminthes	Pp. 256 - 258, 716		½ Week
(a) Ascaris			
(b) Hookworm			
(c) Trichinella			
5. Phylum Annelida	Pp. 258 - 262, 716	28	1 Week
(a) Lumbricus			
(b) Leeches			
6. Phylum Mollusca (general characteristics and examples)	Pp. 265 - 269, 716		½ Week
7. Phylum Echinodermata (general characteristics and examples)	Pp. 269 - 271, 716		½ Week
8. Phylum Arthropoda General characteristics Grasshopper	Chapters 24 and 25, p. 717 P. 273 Chapter 25	29	1 Week
9. Phylum Chordata General characteristics	Chapters 28-33, p. 718 Pp. 320 - 321		5 Weeks
(a) Protochordates — Amphioxus	P. 320		
(b) Subphylum Vertebrata General characteristics Vertebrate systems	P. 321 P. 321		
(1) Class Cyclostomata	Pp. 326 - 327, 718		
(2) Class Chondrichthyes	Pp. 328 - 329, 718		
(3) Class Osteichthyes Omit pp. 337 - 340	Pp. 329 - 336, 718	30	
(4) Class Amphibia	Chapter 30	31 - 35	
(5) Class Reptilia	P. 359 <i>Renewable Natural Resources of Alberta</i> P. 375		
(6) Class Aves (General characteristics and adaptations for flight)			
(7) Class Mammalia	Chapter 33	36	
			11 Weeks

Unit 6: Human Heredity and Change (4 Weeks)

Topic	Reference	Lab.	Time
1. Man's development — Evolutionary approach	Pp. 418 - 423		½ Week
2. Body regulators	Chapter 41		½ Week
3. Review basis of heredity with reference to man	Chapter 49 Pp. 401 - 403		} 1 Week
4. Principles of Heredity	Chapter 50		
(a) Mendel's experiment			
(b) Mendel's laws			
(c) Sex determination			
(d) Gene linkage and crossing over			
(e) Characteristics associated with sex			
(f) Mutations			

5. Applications			
(a) Hybridizing and line breeding	Pp. 637 -638		} 1 Week
(b) Chromosomal aberrations	P. 640		
6. Human Genetics	Chapter 52		
(a) Nature of human heredity	P. 647		
(b) Fraternal and identical twins	P. 648		
(c) Inheritance of acquired skills	P. 649		
(d) Prenatal influence	P. 650		
(e) Blood type and Rh factor —	P. 651		
(f) Characteristics associated with sex		37	
(1) Hemophilia			
(2) Baldness			
(3) Beard characteristics			
7. Changing Life	Chapter 53		1 Week
	<i>Points of View on Theory of Evolution</i> , supplement to <i>Elements of Biology</i> , Weisz		
(a) Change vs. origin			
(b) Evidence of change	Pp. 656- 664		
(c) Theories of change			
(1) Lamarck			
(2) Weismann			
(3) Darwin			4 Weeks
(4) DeVries			
Total Time			35 Weeks

BIOLOGY 32

SPECIFIC OBJECTIVE OF THE BIOLOGY 32 COURSE

1. A survey of the structure and function of principal systems from representatives of each of the major phyla.
2. The handling of the microscope and of other standard laboratory equipment.
3. The accurate observation of biological phenomena in the field and in the laboratory and the precise recording of data.
4. The mastery of skills needed to collect and maintain living specimens, to identify them with the use of keys, and to preserve them for future study.
5. The study of the principles of heredity, and of the history of life on the earth.
6. The application of biological principles to the human body and its functions.

TEXTS AND TEACHER REFERENCES

Texts:

Modern Biology, 1963 Edition, Moon, Otto and Towle.

Laboratory Exercises for Introductory Biology, Department of Education.

Teacher References:

A Sourcebook for the Biological Sciences, Morholt, Brandwein and Joseph.

Elements of Biology, Weisz (Canadian Edition).

Principles of Biology, Buffaloe.

Renewable Natural Resources of Alberta, Department of Education.

TIME SCHEDULE

The following time schedule is suggested. It is anticipated of schools that teachers will depart from this schedule as is appropriate to meet the needs and interests of their particular classes.

Unit	Suggested Time
1	4 Weeks
2	1 Week
3	4 Weeks
4	7 Weeks
5	10 Weeks
6	6 Weeks
7	3 Weeks
	<hr/> 35 Weeks

COURSE OUTLINE — BIOLOGY 32

The following course outline is designed to give teachers guidance with respect to the manner in which the content should be treated in order to best achieve the stated objectives. From time to time reference is made to sources of information other than the authorized text. It is expected that teachers will have available most of the reference books listed on page 10. After certain topics the appropriate laboratory exercises are indicated in brackets. For example laboratory exercises 1, 2, and 3 are felt to be best covered when topic 1 of Unit 1, "The Science of Life", is being studied.

All references are to the text book, unless otherwise indicated.

Unit 1: Introduction (4 Weeks)

Topic	Reference	Lab.	Time
1. Science of Life	Chapter 1	1, 2 and 3	1 Week
Develop from laboratory exercises:			
Scientific attitudes			
The microscope			
Modern compound microscope			1 Week
What biology can do for you			
2. Fundamental Properties of Life	Chapter 2		
3. Chemical Basis of Life	Chapter 3		
4. Structural Basis of Life	Chapter 4	4 and 5	1 Week
(Structure of molecules should serve only to promote understanding and memorization should not be required).			
5. Balance in the World of Life	Chapter 6		
6. Vital Factors of the Environment	Chapter 7		
Omit "Plant Formations of the United States", page 71. Include a survey of the Alberta situation based on the appropriate sections of <i>Renewable Natural Resources of Alberta</i> .			1 Week
7. Functional Basis of Life (Emphasis on life processes)	Chapter 5		1 Week
8. Basis of Heredity (DNA Chemistry for principle only. Structure of molecules should serve to promote understanding but memorization should not be required.)	Chapter 49		
9. Classification of Organisms	Chapter 8		
Stress should be placed on the "modern" system as outlined on page 83. This system should be adhered to in presenting typical organisms in the succeeding chapters.			

Unit 2: Survey of Monera (1 Week)

Topic	Reference	Lab.	Time
1. Phylum Schizophyta	Chapter 10	6	} 1 Week
2. Phylum Cyanophyta	Pp. 91 - 95	7	

Unit 3: Survey of Protista (4 Weeks)

Topic	Reference	Lab.	Time
1. Phylum Chorophyta (Study life cycle of Spirogyra . Omit cycles of Ulothrix and Oedogonium)	Pp. 95 - 100	8 and 9	} 1 Week
2. Phylum Chrysophyta	Pp. 101 - 102		
3. Phyla Phaeophyta and Rhodophyta	P. 101		} 1 Week
4. Phylum Mycophyta Slime molds Fungi (Treat as in text: bread mold, yeast)	Chapter 11	10, 11	
5. Phylum Mastigophora } Euglena Phylum Euglenophyta }	Chapter 20	12	} 1 Week
6. Phylum Sarcodina — Amoeba	Chapter 20	13	
7. Phylum Ciliata — Paramecium	Chapter 20	14	
8. Phylum Sporozoa — Plasmodium	Chapter 20		

Unit 4: Survey of Metaphyta (Kingdom Plantae) (7Weeks)

Topic	Reference	Lab.	Time
1. Phylum Bryophyta Trace the life cycle of moss or liverwort with emphasis on alternation of generations.	Pp. 127 - 130	15	} 1 Week
2. Phylum Tracheophyta			
(a) Class Filicineae	Pp. 130 - 132	16	} 1 Week
(b) Class Gymnospermae	Pp. 139 - 141		
(c) Class Angiospermae			} ½ Week
i General characteristics	Pp. 141 - 145		
ii Root and absorption	Chapter 14 and 15	17, 19 (18 optional)	1 Week
iii Stem	Chapter 16	21 (20 optional)	1 Week
iv Leaf	Chapter 17	22	} 1 Week
Structure	Pp. 184 - 186		
Forms — do in conjunction with field work			
Photosynthesis — Overall pattern only with no chemical detail. (Omit types of chlorophyll, p. 187)		23	
Respiration — no chemical detail.	Pp. 190 - 192		
Translocation and storage	P. 192		
Transpiration (Omit pages 195-198)	Pp. 193 - 194		

v Flower	Chapter 18		
Structure } relate to		24	
Types } field work			
Pollen formation and transfer			} 1 Week
Development of ovule (embryo sac)			
Fertilization			
NOTE: Discuss alternation of generations pointing out the complete dependence of the gametophyte generation.	Pp. 220 - 227 of <i>Principles of Biology</i> , Buffaloe		} ½ Week
vi Seeds	Pp. 216 - 219	25	
(The structure of typical monocot. and dicot. seeds should be noted as a field laboratory exercise.)			

Unit 5: Survey of Metazoa (Kingdom Animalia) (10 Weeks)

Emphasis should be placed upon the increasing complexity of structure, the development of systems and their integration to form complex organisms. Students should understand why the increasing size of organisms brings about a need for various systems.

Topic	Reference	Lab.	Time
General features	Pp. 241 - 242		} ½ Week
1. Phylum Porifera	Pp. 242 - 245, 715		
2. Phylum Coelenterata	Pp. 246 - 249, 715		} ½ Week
Hydra		26	
3. Phylum Platyhelminthes	Pp. 253 - 256, 716	27	} 1 Week
(a) Planarians — general structure			
(b) Flukes — life cycle			
(c) Tapeworms — structure and life cycle			
4. Phylum Nematelminthes	Pp. 256 - 258, 716		} 1 Week
(a) Ascaris			
(b) Hookworm			
(c) Trichinella			
5. Phylum Annelida	Pp. 258 - 262, 716	28	} 1 Week
(a) Lumbricus			
(b) Leeches			
6. Phylum Mollusca (general characteristics and examples)	Pp. 265 - 269, 716		} ½ Week
7. Phylum Echinodermata (general characteristics and examples)	Pp. 269 - 271, 716		
8. Phylum Arthropoda	Chapters 24 and 25, 717		} 1 Week
General characteristics of phylum and classes	P. 273		
Grasshopper	Chapter 25	29	
Classes to be covered as related to field work. Use keys to determine orders of insects collected.			

9. Phylum Chordata	Chapters 28 - 33, 718 - 720		
General characteristics	Pp. 320 - 321		
(a) Protochordates — Amphioxus	P. 320		
(b) Subphylum Vertebrata	P. 321		
General characteristics	P. 321		
Vertebrate systems	Pp. 326 - 327, 718		
i Class Cyclostomata	Pp. 328 - 329, 718		
ii Class Chondrichthyes	Pp. 329 - 336, 718	30	
iii Class Osteichthyes	Omit Pp. 337 - 340		
iv Class Amphibia	Chapter 30	31 - 35	
v Class Reptilia	P. 359		
(General characteristics and examples)	<i>Renewable Natural Resources of Alberta</i>		
vi Class Aves	P. 375		
(General characteristics and adaptations for flight)			
vii Class Mammalia	Chapter 33	36	5½ Weeks

Unit 6: The Human Body — Its Functions (6 Weeks)

Emphasize the relation of structure to function; limit memorization to names of parts necessary to achieve this end.

Topic	Reference	Lab.	Time
1. Man's Development — Evolutionary approach	Pp. 418 - 423		
2. Physical organization			
(a) Cells, tissues, organs and organ systems defined.	Pp. 423 - 425		1 Week
Table, page 424 for reference only).			
(b) The skeleton — function only	Pp. 428		
(c) The muscles — function only	Pp. 431		
3. The Respiratory System	Pp. 459 - 469		½ Week
(Stress the need for gas exchange by the cells)			
4. The Circulatory System	Chapter 38	36	1 Week
(Stress the functions of the component parts. E.g., structure of the heart should be learned as the framework for understanding its function as a pump and the pathway the blood takes in being pumped by the heart. The function of the blood is an important aspect.			
5. The Excretory System			
(a) Excretion defined	Pp. 469 - 472		
(b) Structure of urinary system in man	P. 472		
(c) Structure and function of a nephron	P. 473		½ Week
(d) Other means of excretion			
(Fig. 37-13, p. 475, for reference only.)	Pp. 474 - 475		
6. The Nervous System	Chapter 39		
(a) Three major regions of the brain and the functions of each			
(b) Neuron structure			
(c) Kinds of neurons and their function			1 Week
(d) The reflex arc			
(e) The nerves			
(f) The autonomic nervous system			
(Fig. 39-10, p. 502, for reference only.)			

7. The Body Regulators	Chapter 41	1 Week
8. Reproduction	Chapter 21: <i>Elements of Biology</i> , Weisz	1 Week
(a) Modes of fertilization		
(b) Fate of fertilized egg (zygote)		
(c) Developmental steps of a zygote		
(d) Reproductive systems: note Figures 21.4 and 21.5.		
(e) Embryonic development		1 Week
(1) The pattern		
(2) The process	Pp. 400 - 402, Weisz	
(Omit details of the way the organs develop from each layer. Include formation of the nerve cord.		
(f) Embryo and its environment	Pp. 404 - 407, Weisz	

Unit 7: Heredity and Change (3 Weeks)

Topic	Reference	Lab.	Time
1. Review with special attention to: chromosomes, genes, gene function, mitosis, meiosis, diploidy, haploidy, fertilization	Chapter 49		1 Week
2. Principles of Heredity	Chapter 50		
(a) Mendel's experiment			
(b) Mendel's laws			
(c) Sex determination			
(d) Gene linkage and crossing over			1 Week
(e) Characteristics associated with sex			
(f) Mutations			
3. Applications			
(a) Hybridization and line breeding	Pp. 637 - 638		
(b) Chromosomal aberrations	P. 640		1 Week
4. Human genetics	Chapter 52		
(a) Nature of human heredity			
(b) Fraternal and identical twins			
(c) Inheritance of acquired skills			
(d) Prenatal influence			1 Week
(e) Blood types and Rh factor			
(f) Characteristics associated with sex			
i Hemophilia			
ii Baldness			
iii Beard characteristics		37	1 Week
5. Changing Life	Chapter 53		
(a) Change vs. origin	<i>Points of View on the Theory of Evolution, Supplement to Elements of Biology</i> , Weisz		
(b) Evidence of change	Pp. 656 - 664		
(c) Theories of change			
(1) Lamarck			
(2) Weismann			
(3) Darwin			
(4) DeVries			

35 Weeks

BIOLOGY 30

SPECIFIC OBJECTIVE OF THE BIOLOGY 30 COURSE

1. To emphasize understanding of biological principles rather than memorization of terms, definitions, diagrams, etc. It is assumed that students will have a background knowledge of structure from studies of Biology 20.
2. To develop a deeper understanding of life, through a study in depth of such life processes as:
 - (a) ingestion
 - (b) digestion
 - (c) absorption
 - (d) assimilation
 - (e) elimination
 - (f) excretion
 - (g) sensitivity
 - (h) reproduction

TEXTS AND TEACHER REFERENCES

Texts:

Elements of Biology, Weisz. McGraw-Hill including *Points of View on the Theory of Evolution* (supplement).

Chemical Background for Biology 30, Brown. School Book Branch.

Laboratory Manual: *Laboratory Exercises for Elements of Biology*, McGraw-Hill.

Teacher References:

Science of Biology, Weisz. McGraw-Hill—This book is an elaboration of *Elements of Biology* and is an essential part of the teacher's reference library.

Instructor's Manual to Accompany Elements of Biology, Weisz. McGraw-Hill (This one is recommended.)

Instructor's Manual to Accompany Science of Biology, Weisz. McGraw-Hill.

A Sourcebook for the Biological Sciences, Morholt et al. Harcourt, Brace & Company (Excellent for laboratory techniques).

Principles of Modern Biology, Marsland. Holt, Rinehart & Winston.

General Biology (Revised), Johnson, Laubengayer and Delanney. Holt, Rinehart & Winston.

Principles of Biology, Buffaloe. Prentice-Hall.

Genetics: The Thread of Life } American Education Publications

The Vital Wheel: Metabolism } Education Center, Columbus, Ohio, 43216

(These booklets are available at about sixteen cents each and are valuable references).

Periodicals:

Scientific American: Scientific American Inc., 415 Madison Avenue, New York 17, New York, U.S.A.

Science World: Scholastic Magazines Inc., 33 West 42 Street, New York 36, New York, U.S.A.

TIME SCHEDULE

The following time schedule is suggested. It is anticipated of schools that teachers will depart from this schedule as is appropriate to meet the needs and interests of their specific classes.

Unit	Suggested Time
1	6 Weeks
2	3 Weeks
3	11 Weeks
4	7 Weeks
5	4 Weeks
6	4 Weeks
	<hr/> 35 Weeks

COURSE OUTLINE — BIOLOGY 30

Unit 1: The Living World (6 Weeks)

Topic	Reference	Lab.	Time
1. The Nature of Science	Chapter 1		1 Week
2. Chemical Background	Replacement chapter by Dr. Brown	1, 2	2 Weeks
3. Cell and Organism	Chapter 3	3	1 Week
4. Species and Community	Chapter 4		1 Week
5. Community and Environment	Chapter 5		1 Week

Unit 2: The Living Organism (3 Weeks)

Topic	Reference	Lab.	Time
1. Protoplasm and Cells	Chapter 6	4, 5, 8, 9	3 Weeks
2. Monera and Protista	Chapter 7	Students with only a Science 20 background should familiarize themselves with this material early in the year.	
3. Metaphyta: Advanced plants	Chapter 8		
4. Metazoa: Advanced animals	Chapter 9		

Unit 3: Metabolism (11 Weeks)

Topic	Reference	Lab.	Time
1. Autotrophic Nutrition (Emphasis on (a) Internal transport — essentially Biology 20 review: (b) Photosynthesis — the teacher is recommended to supplement his presentation with Weisz, <i>The Science of Biology</i> . Examination material is limited to the text however.)	Chapter 10	6, 7, 10, 11, 12, 13	3 Weeks
2. Heterotrophic Nutrition	Chapter 11	14, 15, 16	2 Weeks
3. Gas Exchange	Chapter 12	17	1 Week
4. Cellular Metabolism: Respiration	Chapter 13	18, 19, 21	3 Weeks
5. Cellular Metabolism: Energy Utilization	Chapter 14	20	2 Weeks

Unit 4: Self Perpetuation: The Steady State (7 Weeks)

Topic	Reference	Lab.	Time
1. The Pattern of Control	Chapter 15		1 Week
2. Cellular Controls	Chapter 16		1 Week
3. The Body Fluids	Chapter 17	22, 23, 24, 25	3 Weeks

4. Nervous Co-ordination (Omit chart p. 323 except as it applies to the Neural receptors) (The diagram on page 340 is poor. The diagram on page 341 shows the hair cells incorrectly in contact with the tectorial membrane.)	Chapter 18	26, 27, 28	2 Weeks
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Unit 5: Self Perpetuation: Reproduction (4 Weeks)

Topic	Reference	Lab.	Time
1. The Pattern of Reproduction (Mitosis and meiosis are to be taught essentially as a review of Biology 20)	Chapter 19	29	1 Week
2. Reproduction: Monera, Protista, Metaphyta	Chapter 20		1 Week
3. Reproduction: Metazoa	Chapter 21		2 Weeks

Unit 6: Self Perpetuation: Adaptation (4 Weeks)

Topic	Reference	Lab.	Time
1. Heredity	Chapter 22	30, 31, 32	2 Weeks
2. The Mechanism of Evolution	Chapter 23		1 Week
3. The Course of Evolution	Chapter 24 and <i>Points of View</i> Supplement		1 Week
			<hr/> 35 Weeks

SUGGESTIONS REGARDING FIELD TRIPS

It is most desirable that every student in every class go on at least one field trip. Numerous difficulties may make this impractical for every school. Each teacher must determine his own limitations because of number of students, transportation problems, timetable and period length as well as the interests of the class and the available regions for a visit. Permission must always be obtained from appropriate authorities — usually the principal. Liability in event of accidents must be clearly understood.

Preparation

Teacher must cover the route to check details for pre-briefing of the class.

Arrangements with other personnel to assist must be confirmed to avoid confusion.

Class should be given an outline of plans in a pre-briefing session.

Items of special interest and problems to watch should be listed.

Designation of responsibilities for each group should be made here.

Arrangements for transportation, time of departure and return, and equipment needed should be clearly outlined.

Follow-Up

Collected items should be sorted and labelled for future reference.

Information gathered should be summarized and distributed.

Specimens collected should become the basis for laboratory work:

- living specimens kept in an aquarium or terrarium,
- others may be preserved or mounted.

Identification of organisms using a simple key is desirable.

Labelling and mounting for a simple museum will be useful in future years to enlarge the school class outlook.

Assessment

Each participant should appraise trip as a personal help.

Teacher should check usefulness to the course and the school and student.

Problems in management need immediate listing for revising future planning of a similar trip.

Applied Biology Field Trip Suggestions

1. Experimental Farms
2. District Agriculturist and Local Fairs
3. Water Purification Plants and Sewage Disposal Plants
4. Vocational Businesses e.g., Seed Plant

Information Field Trip Suggestions

1. Hospital and Clinic
2. Food Processing Plants
3. Greenhouse or other special production
4. University or Museum

Collecting Field Trip Suggestions

1. A Pond Life Study
2. A Woodland Habitat
3. A Creek or River Habitat
4. Rock Types and Samples
5. Ecology — in any area

SUGGESTED OUTLINE FOR A POND COMMUNITY STUDY

Preparation

1. Divide the class or group into teams — about four.
2. Outline the duties of each team and suggest equipment needed.
3. List equipment to be used:

Glass marking pencils	Forceps, 2
Jars — screw top and wide mouth	Plastic bags — assorted, 4
— gallon or larger, 2	Rubber bands
— quart, 6	String — strong
— pint, 12	Preservative solution
Insect net	Insect killing jar
Plankton net — with metal loop and collecting bottle	
Can #3 with ends out and a #8 mesh soldered on	

Field Work

1. Each group collects different materials, e.g., plankton, sediments, water plants, water animals, etc.
2. Samples collected with ample water in jars and labelled.
3. Plant specimens should be whole if possible.
4. Only one or two of each animal type is needed.
5. Large jars of water, plants, sediment, etc., should be preserved for maintenance in the laboratory and later study.

Follow-Up Work

1. Each group reports on its collection to the class.
2. Identification, labelling and study of the organisms by each group. Phylum level may be sufficient — more detail can follow if interest is good.
3. Description of whole community to show relationships, nutrition groups, etc.
4. Use of reference books to arouse interest and complete study for the interested students.

REFERENCE BOOKS

The following list of reference books contains a wide selection of materials for school libraries. The letters before certain titles indicate the material is of a specific nature or may be of special use. Some priorities on the basis of a \$100 budget per year are suggested by numbers.

f — Field and laboratory work	1 — first \$100
r — Reference	2 — second \$100
p — Periodical	3 — third \$100
t — Teacher's Reference	m — multiple copies desirable

Many of the titles are paperbacks. Schools with a limited budget may develop a reasonably good book collection in a short time by purchasing paperbacks. If funds are available, hard covers are usually a better long term investment.

It is suggested that teachers when ordering library books select several good books covering a broad scope before ordering books that deal with specific topics in depth.

- r ABERCROMBIE, M., HICKMAN, C. J. and JOHNSON, M. L., 1957. *A Dictionary of Biology*, 3rd Edition. Penguin Books. \$1.25.
- 1 ADLER, Irving. 1957. *How Life Began*. Signet Key Book. Ks369. 60 cents.
- ALLEN, A. A. 1951. *The Book of Bird Life*, 2nd Edition. D. Van Nostrand. \$11.75.
- r ANDERSON, R. M. 1946. *Catalogue of Canadian Recent Mammals*. Bulletin No. 102, National Museum of Canada. Queen's Printer, Ottawa.
- f ANDERSON, R. M. 1960. *Methods of Collecting and Preserving Vertebrate Animals*, 3rd Edition. National Museum of Canada.
- p *Animals*. Dept. S., 244 Bay Street, Toronto 1, Ontario. Weekly 50 cents.
- 3 ANTHONY, H. E. 1928. *Field Book of North American Mammals*. Putnam, N.Y. 316 pp. \$4.95.
- 1 ASIMOV, Isaac. 1962. *The Genetic Code*. Signet Science Library. P2250. 60 cents.
- ASIMOV, Isaac. 1962. *The Bloodstream: River of Life*. Collier. AS8. \$1.10.
- 2 ASIMOV, Isaac. 1962. *The World of Carbon*. Collier. AS229. \$1.10.
- 2 ASIMOV, Isaac. 1962. *The World of Nitrogen*. Collier. AS220. \$1.10.
- r AUSTIN, O. L. and SINGER, A. 1961. *Birds of the World*. Golden Press, N.Y. 316 pp. \$20.00.
- f BARKER, W. B. and SPRINGTHORPE, E. G. 1963. *A Concise Biology*. Longmans, Green and Co. 376 pp. \$2.50.
- BATES, M. 1961. *The Forest and the Sea*. Mentor. MD316. 60 cents.
- BATES, M. 1961. *Man in Nature*. Prentice-Hall, Foundations of Modern Biology. \$1.95.
- BEAUMONT, W. 1963. *Experiments and Observations on the Gastric Juice and the Physiology of Digestion*. Dover. S527. \$1.75.
- r BEIRNE, B. P. 1955. *Preparing and Preserving Insects*. Queen's Printer, Ottawa. 133 pp. 50 cents.
- f BENTON, A. H. and WERNER, W. E. 1961. *Manual of Field Biology and Ecology*. Burgess Publishing Co., Minneapolis. \$3.95.
- 3 BERNARD, Claude. 1960. *An Introduction to the Study of Experimental Medicine*. Dover.
- 3 BERRILL, N. J. 1962. *Journey into Wonder: Marvels of the New World*. Collier. AS11. \$1.10.
- f BIBBY, C. 1956. *Simple Experiments in Biology*. Heinemann, London. 216 pp. \$2.00.
- 3f BIRD, R. D. 1961. *Ecology of the Aspen Parkland of Western Canada in Relation to Land Use*. Queen's Printer, Ottawa.
- BONNER, D. M. 1961. *Heredity, Foundations of Modern Biology*, Prentice-Hall, Englewood Cliffs, N.J. (Paper back) \$2.25.
- BONNER, J. T. 1955. *Cells and Societies*. Oxford. 25x. \$5.50.
- BONNER, J. T. 1963. *Morphogenesis: An Essay on Development*. Hollinger House, Antheneum. No. 28. \$2.00
- 1f BOTANY, Department of; University of Alberta, *Collecting and Identifying Plants*. University of Alberta, Department of Extension, Edmonton.
- BOURLIERE, F. 1954. *The Natural History of Mammals*. Alfred A. Knopf, N.Y. \$7.25.
- 2 BROWN, A. 1954. *Old Man's Garden*. J. M. Dent and Sons. \$3.50.
- BSCS. 1963. *Biological Science: An Inquiry Into Life (Yellow Version)*, Harcourt, Brace and World Inc., N.Y. 748 pp. \$6.30.

- BSCS. 1963. *High School Biology*. (Green Version). Rand McNally, Chicago. 749 pp. \$7.55 (Includes lab manual).
- BSCS. 1963. *High School Biology. Molecules to Man* (Blue Version). Houghton Mifflin.
- 3t BSCS. 1963. *Laboratory Blocks and Pamphlet Series*. D. C. Heath.
- 2 BUCHSBAUM, R. 1962. *Animals Without Backbones*. Penguin. A187-8. 2 vols., \$1.25 each.
- 1mf BUDD, A. C. 1957. *Wild Plants of the Canadian Prairies*. Queen's Printer, Ottawa. \$1.50.
- BURR, M. 1954. *The Insect Legion*. James Nisbet and Company, London. \$4.15.
- 2f BURT, W. H. and GROSSENHEIDER, R. P. 1952. *A Field Guide to Mammals*. Houghton Mifflin Co. \$5.95.
- BUTLER, C. G. 1954. *The World of the Honey Bee*. Oxford. 90 cents.
- 1f CARL, G. C. 1959. *The Amphibians of British Columbia*. British Columbia Provincial Museum, Victoria.
- 1f CARL, G. C. 1960. *The Reptiles of British Columbia*. 3rd Edition. British Columbia Provincial Museum, Victoria.
- 1mf CARL, G. C., CLEMENS, W. A. and LINDSEY, C. C. 1959. *The Freshwater Fishes of British Columbia*. 3rd Edition. British Columbia Provincial Museum, Victoria.
- CARSON, Rachel. 1955. *The Edge of the Sea*. Mentor Books. The New American Library, N.Y. 75 cents.
- CHEESMAN, E. 1963. *Insects: Their Secret World*. Apollo Editions, N.Y. AE15. \$1.95.
- 3f CHRISTENSEN, C. M. 1955. *Common Fleshy Fungi*. 2nd Edition. Burgess Publishing, Minneapolis.
- 3 CLARK, W. E. Le Gros. 1960. *History of the Primates*. British Museum (Natural History) London. 75 cents.
- CLAUSEN, Lucy. 1962. *Insect Fact and Folklore*. Collier. AS78. \$1.10.
- CLAY, T. and ROTHCHILD, M. *Fleas, Flukes and Cuckoos*. Collins, New Naturalist, London.
- COLLIS, J. S. 1950. *The Triumph of the Tree*. Jonathan Cape, London. 254 pp. \$1.65.
- 2f CONRAD, H. S. 1944. *How to Know the Mosses*. Wm. C. Brown Co., Dubuque, Iowa. \$3.75.
- CORNER, G. W. 1963. *The Hormones in Human Reproduction*. Hollinger House, Antheneum, No. 16. \$2.00.
- f COWAN, I. McT. and GUIGUET, C. J. 1960. *The Mammals of British Columbia*. British Columbia Provincial Museum, Victoria.
- CROAL, A. G., LOUDEN, A. H. and SMITH, L. A. 1955. *General Biology*. 2nd Edition. Copp Clark. \$5.00
- CUNNINGHAM, G. C. 1958. *Forest Flora of Canada*. Queen's Printer, Ottawa.
- DARWIN, C. 1963. *Autobiography and Selected Letters*. Dover. T479. \$1.90.
- 3 DARWIN, C. 1962. *Origin of Species*. Collier. HS34. 80 cents.
- DAVIES, J. L. *Seeds of Life*. Signet Key. KS345. 35 cents.
- r DEASON, H. J., LYNN, R. W. 1961. *An Inexpensive Science Library*. 5th Edition. American Association for the Advancement of Science, Washington.
- 1m DEPARTMENT OF FORESTRY. 1962. *Native Trees of Canada*. Bulletin 61, 6th Edition. Queen's Printer, Ottawa. \$2.00.
- DOBZHANSKY, T. 1960. *The Biological Basis of Human Freedom*. Columbia Paperback. \$1.25.
- f DODGE, R. A. et al. 1952. *Elements of Biology*. Allyn and Bacon, N.Y.
- 3 EDLIN, H. L. 1956. *Trees, Woods, and Man*. New Naturalist. Collins. 272 pp. \$6.75.
- EDMINSTER, F. C. 1954. *American Game Birds of Field and Forest*. Charles Scribner's Sons, N.Y. \$15.00.
- EHRENSVARD, G. 1963. *Life, Origin and Development*. University of Chicago Press. Paper \$1.75.
- r ESSIG, E. O. 1926. *Insects of Western North America*. Macmillan, N.Y. \$23.50.
- f *Facilities and Equipment for Science and Mathematics*. 1960. U.S. Government Printing Office, Washington 25, D.C.
- 2 FARB, Peter. 1963. *Ecology, Life Nature Library*. Time Inc. 192 pp. \$5.50.
- Others in series: *The Earth, The Sea, The Forest, The Desert, The Mountains, The Universe, The Poles, Evolution, The Insects, The Fishes, The Reptiles, The Birds, The Mammals, The Plants*.
- FERNALD, M. L. 1950. *Gray's Manual of Botany*. 8th Edition. American Book Company. 1632 pp.
- FIELD, M. *See How They Grow*. Pelican. A242. 85 cents.
- 1 FLANAGAN, D. (Editor). 1955. *The Physics and Chemistry of Life*. Scientific American, Simon and Schuster. \$1.60.

- f FRANKTON, C. 1955. *Weeds of Canada*. Queen's Printer, Ottawa.
- FREE, J. B. and BUTER, C. G. 1959. *Bumblebees*. The New Naturalist. Collins, London. 208 pp. \$5.50.
- FROST, S. W. 1963. *Insect Life and Insect Natural History*. Dover. T517. \$2.85.
- 3 GABRIEL, M. L. and FOGEL, S. (Editors). 1955. *Great Experiments in Biology*. Prentice-Hall. \$4.50.
- GALSTON, A. W. 1961. *The Life of the Green Plant*. Prentice-Hall, Foundations of Modern Biology. \$1.75.
- GERTSCH, W. J. 1949. *American Spiders*. D. Van Nostrand. \$9.50.
- GOETSCH, W. 1957. *The Ants*. University of Michigan Press, Ann Arbor. \$2.45.
- GOLDSTEIN, P. 1961. *Genetics is Easy*. 2nd Edition. Viking Press, N.Y. \$1.69.
- 2 GRIFFIN, D. R. 1962. *Animal Structure and Function*. Holt, Rinehart and Winston. 128 pp. \$1.92.
- 3 GRZIMEK, B. and GRZIMEK, M. 1960. *Serengeti Shall Not Die*. Hamish Hamilton. 344 pp. 30 \$6.75.
- 3f HALE, M. E., Jr. 1961. *Lichen Handbook*. Smithsonian Institution, Washington.
- HANSON, E. D. 1961. *Animal Diversity*. Foundations of Modern Biology, Prentice-Hall. \$1.75.
- f HARDY, G. A. and HARDY, W. V. 1949. *Wild Flowers in the Rockies*. H. R. Larson Publishing, Saskatoon. \$9.50.
- HARRIS, J. R. 1952. *An Angler's Entomology*. The New Naturalist. Collins. 268 pp. \$6.75.
- HEGNER, R. and STILES, K. 1951. *College Zoology*. 6th Edition, Macmillan. \$9.50.
- f HICKMAN, C. P. 1955. *A Field Manual of Animal Ecology and Natural History*. Burgess Publishing, Minneapolis.
- r HILL, J. B., OVERHOLTS, L. O., POPP, L. W. and GROVE, A. P. Jr. 1960. *Botany, A Textbook for Colleges*. 3rd Edition. McGraw-Hill. 572 pp. \$10.25.
- HOCHBAUM, H. A. 1955. *Travels and Traditions of Waterfowl*. University of Minnesota Press. \$6.95.
- 2 HOCKING, B. 1963. *The Ultimate Science*. Canadian Broadcasting Corporation. 85 pp. Paper \$1.00. Hard Cover \$1.75.
- HOOKE, Robert. 1963. *Micrographia of Minute Bodies*. Dover. T8. \$2.30.
- f HURD, P. D. *Science Facilities for High Schools*. Stanford University Press, California. \$16.50.
- r IMMS, A. D. 1957. *A General Textbook of Entomology*. 9th Edition. Ryerson. \$6.75.
- IMMS, A. D. 1947. *Insect Natural History, the New Naturalist*. Collins. 317 pp.
- r JACQUES, H. E. 1947. *How to Know the Insects*. Wm. C. Brown Co. \$3.50.
- 1f JAHN, T. L. 1949. *How to Know the Protozoa*. Wm. C. Brown Co. \$3.50.
- JEPSON, G. L., SIMPSON, G. G. and MAYR, E. 1963. *Genetics, Palaeontology, and Evolution*. Hollinger House, Atheneum. No. 35. \$2.35.
- 3 KALMUS, H. 1948. *Genetics*. Penguin Books. A179. 60 cents.
- KALMUS, H. 1957. *Variation and Heredity*. Routledge and Kegan Paul Ltd., London. 227 pp.
- 2f KALMUS, H. 1953. *Simple Experiments With Insects*. Heinemann, London. \$2.00.
- 1f KASTON, B. J. 1952. *How to Know the Spiders*. Wm. C. Brown Co. \$3.50.
- 1f KLOTS, A. B. 1951. *A Field Guide to Butterflies*. Houghton Mifflin. 349 pp. \$5.95.
- KROEBER, E., WOLFF, W. H. *Adventures With Animals and Plants*. Copp Clark.
- p KRANZER, Herman C. *American Biology Teacher*. Burrows Building, Pennsylvania State University, University Park, Pennsylvania. Issues yearly.
- KRUTCH, J. W. 1961. *The World of Animals*. Simon and Schuster, N.Y. 508 pp. \$12.00.
- 2 LACK, David. 1957. *Evolutionary Theory and Christian Belief. The Unresolved Conflict*. Methuen and Co., London, 128 pp. \$2.50.
- LARGE, E. C. 1940. *The Advance of the Fuungi*. Jonathan Cape. London. 488 pp. \$6.25.
- f LAWSON, C. and PAULSON, R. *Laboratory and Field Studies in Biology*, Holt, Rinehart and Winston. \$4.75.
- LEEUVENHOEK, L. 1963. *His Little Animals*. Dover. S594. \$2.60.
- LEVINE, R. P. 1962. *Genetics*. Holt, Rinehart and Winston. 192 pp. \$2.25.
- 3f LUTZ, F. E. 1948. *Field Book of Insects*. 3rd Edition. G. P. Putnam's Sons, N.Y. \$4.95.
- f MACAN, T. T. 1960. *A Guide to Freshwater Invertebrate Animals*. Longmans, London. 188 pp. \$2.75.

- 1mf MCMULLEN, R. D. 1955. *The Insect Collector's Guide*. Entomological Society of Alberta. 36 pp. 25 cents.
- MAETERLINCK, M. 1901. *The Life of the Bee*. George Allan and Unwin, London. 356 pp.
- MASON, A. S. 1960. *Health and Hormones*. Pelican Books. A487. 85 cents.
- MEDAWAR, P. B. 1959. *The Future of Man*. The Reith Lectures. Methuen and Company, London. 128 pp. \$2.50.
- 2t MILLER, D. F. and BLAYDES, G. W. 1962. *Methods and Materials for Teaching Biological Sciences*. McGraw-Hill, N.Y. 2nd Edition
- MILLER, R. B. 1962. *A Cool Curving World*. Longmans, Toronto. 220 pp. \$5.25.
- MILNE, L. J. and MILNE, M. 1958. *The Biotic World and Man*. 2nd Edition. Prentice-Hall, N.Y. 530 pp. \$10.50.
- MOMENT, G. et al. 1962. *Frontiers of Modern Biology*. Houghton Mifflin.
- 1f MORGAN, A. H. 1903. *Field Book of Ponds and Streams*. 8th printing. G. P. Putnam's Sons, N.Y. 448 pp. \$4.00.
- 1f MORHOLT, E. et al. 1958. *A Sourcebook of the Biological Sciences*. Harcourt, Brace and World, N.Y. \$7.80.
- MORRIS, H. M. and WHITCOMB, J. C. 1961. *The Genesis Flood*. The Presbyterian and Reformed Publishing Co., Philadelphia. 518 pp.
- 3r MOSS, E. H. 1960. *Flora of Alberta*. University of Toronto Press, Toronto. 546 pp. \$10.00.
- f MUENSCHER, W. C. 1903. *Keys to Woody Plants*. 3rd Edition. Published by the author. Ithaca, N.Y. \$1.75.
- f MURIE, O. J. 1954. *A Field Guide to Animal Tracks*. Houghton Mifflin. \$5.95.
- MURPHY, R. C. and AMADON, D. 1953. *Land Birds of America*. McGraw-Hill. \$9.95.
- 2p *Natural History*. Incorporating Nature Magazine. The Journal of the American Museum, Natural History, N.Y. Monthly 50 cents.
- f NEEDHAM, J. G. et al. *Culture Methods for Invertebrate Animals*. 590 pp. \$2.75.
- 1mf NEEDHAM, J. G. and NEEDHAM, P. R. 1941. *A Guide to the Study of Freshwater Biology*. Comstock Publishing Co., Ithaca, N.Y. 89 pp. \$3.95.
- OAKLEY, K. P. and MUIR-WOOD, H. M. 1959. *The Succession of Life Through Geological Time*. British Museum (Natural History) London. 75 cents.
- 2 OLDROYD, H. 1960. *Insects and Their World*. British Museum (Natural History), London. \$1.00.
- OPARIN, A. I. 1963. *Origin of Life*. Dover. S213. \$2.05.
- 3t *Organization for Economic Cooperation and Development*. 1963. New Thinking in School Biology. The Directorate of Scientific Affairs. Belgium. 320 pp. Canadian Agents — Queen's Printer, Ottawa. \$3.00.
- 1mf PALMER, C. M. 1959. *Algae in Water Supplies*. An illustrated manual on the identification, significance and control of algae in water supplies. U.S. Department of Health Education and Welfare. Public Health Service Publication N. 657. Supt. of Documents, U.S. Government Printing Office, Washington 25, D.C. 88 pp. \$1.00.
- PESSON, P. 1959. *The World of Insects*. George G. Harrap and Co., London. 204 pp.
- 2f PETERSON, R. T. 1947. *A Field Guide to Birds*. 2nd Edition. Houghton Mifflin. 200 pp. \$5.95.
- PLEDGE, H. T. 1939. *Science Since 1500*. Her Majesty's Stationery Office, London. 357 pp. \$3.50.
- 3f POHL, R. W. 1953. *How to Know the Grasses*. Wm. C. Brown Co. \$3.50.
- f POND, G. G. *Science Materials: Preparation and Exhibition for the Classroom*. 132 pp. \$3.50.
- PORTMANN, A. 1959. *Animal Camouflage*. University of Michigan Press, Ann Arbor. AAS506. \$2.25.
- 1mf PRESCOTT, G. W. 1954. *How to Know the Freshwater Algae*. Wm. C. Brown Co. \$3.50.
- PUTNAM, H. L. 1960. *Isotopes*. Penguin Books. A476. \$1.85.
- RAY, P. M. 1963. *The Living Plant*. Holt, Rinehart and Winston. 144 pp. \$2.25.
- REID, L. *The Sociology of Nature*. (Earth's Company) Penguin Books. \$1.25.
- RICHARDS, O. W. 1953. *The Social Insects*. MacDonald, London. \$2.00.
- RICHARDS, P. 1950. *Mosses*. King Penguin. \$2.00.
- 2 ROMER, A. S. 1954. *Man and the Vertebrates*. Penguin Books. A303-4. 2 Vols. \$1.25 each.
- ROWETT, H. G. Q. 1959. *Basic Anatomy and Physiology*. John Murray, London. \$4.20.
- 1 SALT, W. R. and WILK, A. L. 1958. *The Birds of Alberta*. School Book Branch, Edmonton. \$ 5.00.
- f SANKEY, J. 1960. *A Guide to Field Biology*. Longmans, London. 166 pp. \$2.95.
- SAVILE, D. B. O. 1962. *Collection and Care of Botanical Specimens*. Queen's Printer, Ottawa. \$2.00.

- SAVORY, T. H. 1961. *Spiders, Men and Scorpions*. University of London Press. 191 pp. \$6.75.
- f *School Facilities for Science Instruction*. 1954. National Science Teachers Association, Washington, D.C.
- 1p *The Science Teacher*. 1201 Sixteenth Street N.W., Washington 6, D.C. 8 issues per year. \$6.00 includes NSTA membership.
- p *Science World*. 33 West 42 Street, New York 36, N.Y. Teacher's Edition \$2.00, Student Edition \$1.50.
- 1p *Scientific American*. The Scientific American Inc., 415 Madison Avenue, New York 17, N.Y. Monthly 50 cents.
- 2 *Scientific American Offprints*. Readings in the Life Sciences. W. H. Freeman and Co., San Francisco, California. Many titles. 20 cents each.
- t SELKURT, E. E., 1962. *Physiology*. Little, Brown & Co., Boston. 720 pp. \$7.50.
- 1t SIMPSON, G. G., PITTENDRIGH, C. S. and TIFFANY, L. H. 1957. *Life, And Introduction to Biology*. Harcourt, Brace and Co., N.Y. 845 pp. \$7.50.
- 3 SINGER, C. 1931. *A Short History of Biology*. Oxford. 572 pp. \$11.00.
- SINGER, C. 1963. *A Short History of Anatomy and Physiology*. Dover. T389. \$2.05.
- SISTROM, W. R. *Microbial Life*. Holt, Rinehart and Winston. 128 pp. \$1.92.
- SMITH, E. T. 1954. *Exploring Biology*. 4th Edition. Harcourt, Brace and Co.
- 3 SMITH, J. M. 1958. *The Theory of Evolution*. Pelican Books. A433. \$1.65.
- SMITH, K. M. *Beyond the Microscope*. Penguin Books. A119. 85 cents.
- f SMITHSONIAN INSTITUTION. 1944. *A Field Collector's Manual in Natural History*. Publication 3766. The Smithsonian Institution, Washington, D.C. 118 pp.
- 1 SOPER, J. D. 1964. *The Mammals of Alberta*. Hamly Press, Edmonton. 404 pp. \$5.00.
- 3 STEPHENSON, E. M. 1946. *Animal Camouflage*. Penguin Books. A147. 50 cents.
- STORER, J. H. *The Web of Life*. Signet Key. Ks333. 60 cents.
- STORER, T. I. and USINGER, R. L. 1957. *General Zoology*, 3rd Edition. McGraw-Hill. \$9.50.
- SUTTON-VANE, S. 1962. *The Story of Eyes*. The Viking Press, N.Y. 222 pp. \$4.50.
- SWANSON, C. P. 1960. *The Cell*. Prentice-Hall, Foundations of Modern Biology. 114 pp. \$2.25.
- 3 SWANSON, C. P. 1960. *The Cell*. Prentice-Hall, Foundations of Modern Biology. \$1.95.
- r TAVERNER, P. A. 1934. *Birds of Canada*. National Museum of Canada. Ottawa.
- TAYLOR, A. E. 1963. *Aristotle*. Dover. T280. \$1.15.
- TAYLOR, G. R. 1963. *The Science of Life*. McGraw-Hill. \$10.60.
- t *The Teaching of Science in Secondary Schools*. 1958. 2nd Edition. John Murray, London. \$4.00.
- TEILHARD de CHARDIN, P. 1961. *The Phenomenon of Man*. Readers Union, Collins, London. 320 pp. \$2.25.
- 1f *Turtlox Service Leaflets*. General Biological Supply House, 8200 South Hoyne Avenue, Chicago 20. Free, one set to a school, extra copies 4 cents per leaflet. 60 titles.
- URQUHART, F. A. 1949. *Introducing the Insect*. Clarke, Irwin. \$5.00.
- VALLERY-RADOT, R. 1963. *The Life of Pasteur*. Dover. T632. \$2.30.
- von BUDDENBROCK, W. 1953. *The Senses*. University of Michigan Press. 167 pp. \$2.25.
- 3 von FRISCH, K. 1954. *The Dancing Bees*. Methuen and Co. 183 pp. \$3.75.
- von FRISCH, K. 1962. *About Biology*. Oliver and Boyd, Edinburgh. 287 pp. \$5.50.
- WALKER, K. M. *Human Physiology*. Penguin Books. A102. \$1.25.
- WALLACE, B., and A. M. SRB. 1961. *Adaptation*. Prentice-Hall Foundations of Modern Biology. 114 pp. \$2.25.
- 1 *Ward's Culture Leaflets*. Ward's Natural Science Establishment, Rochester, N.Y. Single copies free on request, 24 titles.
- 2t WEISZ, P. B. 1963. *The Science of Biology*. 2nd Edition. McGraw-Hill. 786 pp. \$10.25.
- WELTY, J. C. 1962. *The Life of Birds*. Saunders, Philadelphia. 540 pp. \$10.25.
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BIOLOGY EQUIPMENT AND SUPPLIES LIST

FOR BIOLOGY 20, 32 and 30

PART I: EQUIPMENT

	Biology 20 and 32	Biology 30
(a) Glassware:		
Beakers — 1 set consisting of each of 50, 100, and 400 ml.	x	x
Beaker 1000 ml.	x	x
Culture bottles for Drosophila (½ pint milk bottles satisfactory)		x
Cylinders, graduated, 100 ml. (low type)		x
Flasks, Erlenmeyer, 250 ml.		x
Florence, 300 ml.		x
Funnel, filter		x
Glass Tubing, ⅛" diameter	x	x
4' x 45 mm. Outside diameter	x	
Ignition tube, 25x200 mm.		x
Jars, "Gem" (1 quart sealer)		x
Medicine dropper	x	x
Mortar and pestle		x
Petri dish	x	x
Pipette, 10 ml.		x
Respirometer	x	x
Stirring rod, 8"	x	x
Test tubes, # 4 15 x 125 mm.		x
# 6 18 x 155 mm.		x
#17 25 x 300 mm.		x
13 x 100 mm. no lip		x
Thistle funnel		x
Vials, glass with screw top 21 x 70 mm.		x
(b) Apparatus:		
Air breaker stones	x	x
Aquarium, 10 gal. minimum	x	x
Aquarium accessories (heater, thermostat, filter, sand, etc.)		
Autoclave, (pressure cooker with pressure gauge)	x	x
Balance, triple beam	x	x
Burner, Bunsen	x	x
Centrifuge, hand (optional)		x
Cheese cloth	x	x
Clamps, burette		x
Cotton, absorbent	x	x
non-absorbent	x	x
Cover slips, microscope, 22 mm. square	x	x
Culture tube rack (or test tube rack) (48 or 72 hole)	x	x
Dialysis cellulose tubing, ⅝" diameter	x	x
Dissecting probes, straight and sharp	x	x
blunt	x	x
Dissecting scissors	x	x
tray, waxed	x	x
Distillation apparatus (1 per school)		
Dry cell, 1½ volt		x
File, triangular	x	x

	Biology 20 and 32	Biology 30
Filter paper, 15 cm.		X
Forceps dissecting	X	X
Grease marking pencil	X	X
Incubator (optional but desirable) 8 sq. ft. of shelf space	X	X
Labels, adhesive	X	X
Lens, hand 10x	X	X
Microscope, student, 1 per two students (40x to 400x approx.)	X	X
Microscope, dissecting (at least 4 per class of 28)	X	X
Microscope, oil immersion (at least 1 per class)	X	X
Nails, 4"		X
Needles, hypodermic (disposable) 1", 22 gauge		X
Needles, inoculation (loop)	X	
Paper bag, #8		X
Pinning board, for frog (can be made locally)		X
Refrigerator, (min. capacity of 8 cu. ft. with freezer compartment)	(1 per classroom lab.)	
Ringstand, 18"	X	X
Ring support	X	X
Rubber bulb, 25 ml.	X	X
Rubber hose, 1/8"		X
Sand, fine washed (collect locally)		X
Scalpel, surgical (handle only)		
Scalpel blades	X	X
Seed flat, 12" x 12" x 3" (make locally)	X	X
Slides, microscope, plain	X	X
Sphygmomanometer, aneroid		X
Stethoscope	X	X
Stoppers, cork assorted	X	X
gum rubber, one hole # 3 (18 - 24 mm diameter)		X
#12 (37 - 45 mm diameter)	X	
gum rubber, solid # 2 (16 - 20 mm diameter)		X
# 5 (23 - 27 mm diameter)		X
# 7 (30 - 37 mm diameter)		X
#30 (13 - 17 mm diameter)		X
Syringe, hypodermic, disposable		X
Test tube brush	X	X
Test tube holder	X	X
Thread, #40		X
Tissue, lens	X	X
Tongs	X	X
Tooth picks	X	X
Wire asbestos gauze, 6" squares	X	X
Wire, copper, insulated, 18 gauge (approx.)		X

PART II: SUPPLIES

Adhesive tape	X	X
Aluminum foil	X	
Applicator sticks		X
Aspirin		X
Blood typing sera. Anti-A and Anti-B		X
Corn meal, (for fruitfly culture only)		X

	Biology 20 and 32	Biology 30
Corn syrup, (for fruitfly culture only) (Karo)		X
Gelatin		X
Immersion oil (for use with oil immersion microscope)	X	X
Litmus papers, red and blue	X	
Molasses, dark (for fruitfly culture only)		X
Mold inhibitor, (for fruitfly culture only)		X
Olive oil		X
Phenylthiocarbamide taste test papers (PTC)		X
Pins, dissecting	X	X
insect	X	X
Plastic bags	X	X
pH papers or pH meter	X	X
Skim milk powder (obtain locally)		X
Sodium benzoate taste test papers		X
Vacuum wax		X
Varnish, urethane	X	X
Vaseline	X	X

PART III: FRESH OR PRESERVED SPECIMENS

(Collect locally where possible — See Lab. Books for guidance)

Albino Sorghum seeds (Kaffir corn)	X	
Algae (many forms—filamentous, desmids, etc.)	X	
Brine shrimp eggs (dried but living)	X	
Coleus , potted living plant	X	
Drosophila (See Lab. #32, Biol. 30) Wild and Vestigial wing		X
Earthworm, preserved	X	
Elodea (living)		X
Fern, sporophyte (could be potted fern)	X	
gametophyte (preserved)	X	
Fish, frozen or preserved, (perch or any local fish)	X	
Frog, preserved, double injected	X	
Frog, living		X
Geranium, potted living plant	X	
Grasshopper, lubber, preserved	X	
Hydra sp, living preferred	X	
Liverwort, living (showing antheridial and archegonial structures)	X	
Moss, living (showing sporophyte)	X	
Planarian (may be collected locally in some areas)	X	
Seeds, radish, bean, corn	X	
Tapeworm, preserved	X	
Woody stem (tree sections) cut to show radial, tangential, cross, and longitudinal views (make locally)	X	
Yeast, dry, bakers	X	

PART IV: PREPARED MICROSCOPE SLIDES

Amoeba sp	X	
Blood, human		X
Bread mold (Rhizopus sp), Conjugating	X	
Earthworm, c.s. through intestine	X	
Hydra sp, w.m. budding	X	

	Biology 20 and 32	Biology 30
Leaf, c.s.	X	
Planarian, w.m. and c.s.	X	
Root tip, l.s.	X	
Root, c.s.	X	
Spirogyra sp, conjugating	X	
Stem, woody dicot, c.s.	X	
herbaceous dicot, c.s.	X	
monocot c.s.	X	
Tapeworm, w.m.	X	

PART V: REFERENCE BOOKS

Demerec & Kaufmann, <i>Drosophila Guide</i> , Carnegie Institute of Washington, 1530P Street N.W., Washington 5, D.C., 20036		X
Morholt, E., Brandwein, P. J., Joseph, A., <i>A Sourcebook for the Biological Sciences</i> , Harcourt, Brace and Company, New York. 1958.	X	X

PART VI: CHEMICALS

Acetic acid, glacial	X	X
Acetone	X	
Acetylcholine		X
Adrenalin sulphate		X
Agar-agar, granulated	X	X
Ammonium hydroxide	X	X
Ammonium oxalate	X	
Ammonium phosphate		X
Barium hydroxide		X
Benedict's solution	X	X
Benzine		X
Bile salts		X
Calcium carbonate, powdered	X	
Calcium carbonate, chips		X
Calcium chloride, flakes		X
Calcium hydroxide, powdered		X
Calcium sulphate, powdered		X
Carbon tetrachloride	X	X
Chloroform	X	
Chromic nitrate		X
Cupric sulphate		X
Dextrose (Glucose)	X	X
Dyes: Acid alcohol	X	
Brom thymol blue (powder)	X	X
Carmine, soluble		X
Crystal violet	X	
Gram's iodine (can be prepared — see appendix, Bio. 30)	X	
Janus green		X
Methylene blue	X	X
Neutral red		X
Safranin (1% aqueous)	X	X
Sudan IV		X
Ether, diethyl	X	X

	Biology 20 and 32	Biology 30
Ethyl alcohol, 95%, denatured	X	X
Ethylene glycol		X
Ferric chloride		X
Ferric nitrate		X
Ferrous sulphate, crystal		X
Formaldehyde, (40% — formalin)	X	
Fructose		X
Glycerine	X	X
Glycogen		X
Hydrochloric acid		X
Hydrogen peroxide		X
Iodine, crystal	X	X
Isopropyl alcohol	X	X
Limewater tablets		X
Maltose		X
Manganese chloride		X
Manganese dioxide		X
Mercuric chloride		X
Methyl alcohol	X	
Methyl cellulose	X	
Nitric acid		X
Oxalic acid		X
Pancreatin, powder		X
Pepsin, powder		X
Phenolphthalein		X
Potassium chlorate, crystal		X
chloride		X
ferrocyanide		X
bisulphate		X
hydroxide, flakes		X
iodide	X	X
oxalate		X
permanganate		X
Pyrogalllic acid, crystal		X
Quinine sulphate		X
Rennet tablets (Junket)		X
Silver nitrate, crystal		X
Soap, liquid green		X
Sodium bicarbonate		X
carbonate		X
chloride		X
fluoride		X
hydroxide, flakes		X
silicate, solution (water glass)		X
Starch, corn	X	X
Sucrose		X
Sulphuric acid		X

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