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THE TEACHING OF BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON

by

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can University of Beirut

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PREFACE

The purposes of this study are:

- a. To investigate the present status of biology teaching in the secondary schools of Lebanon.
- b. To present the views of modern educational specialists on the teaching of biology.
- c. To recommend in the light of the findings in (a) and (b) a broad program for the improvement of biology teaching in the secondary schools of Lebanon.

The delimitations of the study are:

- a. It concerns itself with a sample representing the two main type schools in Lebanon rather than with a particular type of secondary school.
- b. It is concerned with the teaching of biology in all of the secondary grades rather than in a particular grade.
- c. It investigates only the teaching of biology; no attempt is made to study its relationships with other subjects in the curriculum.
- d. It is not intended to be a critical study of philosophical, psychological and educational viewpoints. These are traced only to the extent that they are helpful in aiming at practical suggestions for biology teaching.

e. It is not a source book in biology. However, some parts, especially if slightly modified for the purpose, may be of use to the classroom biology teacher.

It is the belief of the writer that biology is one of the subjects which is most useful in giving students an understanding of and a balanced attitude toward life. Since the functional value of biology depends upon such factors as the training of teachers, the methods of instruction, the textbooks used etc., a study such as this may be useful in the reconstruction of biology teaching in the secondary schools of Lebanon.

For valuable help in the preparation of this thesis, I am indebted to the following persons:

Dr. Habib Kurani, for granting a scholarship to undertake the necessary research, and for writing introductory letters for the visits to schools.

Dr. Frederick Korf, for his special guidance and assistance throughout the preparation of the thesis.

Dr. Joseph Butros, Professors Emile Dumit and Jibrail Katul for their helpful suggestions.

The sample of biology teachers and students in the secondary schools of Lebanon, and the sample of Freshman and Sophomore students at A.U.B. for their cooperation in responding to the questionnaires.

TABLE OF CONTENTS

	Page
PART I WHY TEACH BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON?	
CHAPTER I THE EXISTING STATUS OF THE AIMS OF BIOLOGY TEACHING IN THE SECONDARY SCHOOLS OF LEBANON	1
1. The Opinions of Teachers on the Aims of Biology Teaching	1
2. The Opinions of Biology Students on the Aims of Biology Teaching.....	9
3. Summary of Chapter I.....	11
CHAPTER II THE AIMS OF BIOLOGY TEACHING IN MODERN EDUCATIONAL THOUGHT.....	12
1. The Aims of Education.....	13
2. The Aims of Secondary Schools.....	18
3. The Aims of Science Teaching	21
4. The Philosophy of Education of Lebanon....	24
5. Summary of Chapter II.....	26
CHAPTER III WHAT SHOULD BE THE AIMS OF BIOLOGY TEACHING IN THE SECONDARY SCHOOLS OF LEBANON?.....	27
1. Comparison of the Aims of Biology Teaching as Seen by Biology Teachers and Students in Lebanon and by Modern Educational Specialists.....	27
2. Recommendations of Appropriate Aims of Biology Teaching for the Secondary Schools of Lebanon.....	30

3. Summary of PART I.....	33
PART II WHAT SHOULD BE TAUGHT IN BIOLOGY IN THE SECOND-	
ARY SCHOOLS OF LEBANON.....	
CHAPTER IV THE EXISTING STATUS OF THE SUBJECT MATTER	
OF BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON	34
1. The Opinions of Biology Teachers on the	
Importance of Some Criteria for the Selection	
of Subject Matter in Biology	34
2. The Opinions of Biology Teachers on the Im-	
portance of Some Units of Subject Matter in	
Biology.....	41
3. Biology Textbooks.....	49
4. Grade Level of Biology.....	54
5. Summary of Chapter IV.....	56
V THE SUBJECT MATTER OF BIOLOGY ACCORDING TO	
MODERN EDUCATIONAL THOUGHT.....	58
1. The Aims of Biology Teaching.....	59
2. A Theory of Knowledge.....	60
3. The Nature of Biology Students.....	62
A. The interests of students.....	62
B. The needs of students.....	65
C. The mental maturity of students.....	67
4. Imposed Requirements.....	67
5. Summary of Chapter V.....	71

	Page
VI WHAT SHOULD BE THE SUBJECT MATTER OF BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON.....	72
1. Comparison of the Opinions of Modern Spe- cialists in Education and Biology Teachers in Lebanon on Subject Matter in Biology..	72
2. Evaluation of Subject Matter of Biology in Baccalaureat Program.....	75
3. Evaluation of Subject Matter of Biology in General Certificate Examination Program..	79
4. Evaluation of Subject Matter in Biology of A.U.B. Biology Program.....	80
5. Recommendation of Biology Program for the Secondary Schools of Lebanon.....	83
6. A Summary of PART II.....	103
PART III HOW SHOULD BIOLOGY BE TAUGHT IN THE SECONDARY SCHOOLS OF LEBANON?	
VII THE EXISTING STATUS OF THE METHODS OF BIOLOGY TEACHING IN THE SECONDARY SCHOOLS IN LEBANON	104
1. The Methods Used to Teach Biology in the Secondary Schools in Lebanon.....	105
2. The Nature of the Teaching Procedures.....	107
A. The activities of the biology teachers during the biology lesson.....	109
B. The behavior of biology students during the biology lesson.....	111

	Page
C. Other activities associated with the methods of biology teaching.....	113
D. The nature of the biology laboratory	115
E. Summary of Chapter VII	121
VIII THE METHOD OF BIOLOGY TEACHING IN MODERN EDUCATIONAL THOUGHT.....	123
1. The Aims of Biology Teaching.....	124
2. The Nature of Biological Subject Matter.....	125
3. The Learning Process.....	125
4. The Psychology of Students.....	132
A. The characteristics of adolescents	132
B. The interests of students.....	134
C. Individual differences.....	137
5. Summary of Chapter VIII.....	140
IX WHAT SHOULD BE THE METHODS OF BIOLOGY TEACHING IN THE SECONDARY SCHOOLS OF LEBANON?.....	141
1. Comparison of the Opinions of Modern Specialists in Education and Biology Teachers in Lebanon on the Methods of Biology Teaching.....	141
2. Recommended Methods of Biology Teach- ing in the Secondary Schools of Lebanon	142
A. The lecture.....	142
B. The textbook-recitation method.....	144

	Page
C. The demonstration method.....	148
D. The socialized method.....	150
E. The laboratory method.....	153
3. Other Aspects of Biology Teaching Methods..	157
A. Audio-visual methods and materials for biology teaching.....	157
B. Evaluation of the progress of students..	162
C. The biology teacher.....	168
4. Recommended Methods for Some Special Topics	174
5. Summary of PART III	181
PART IV A LOOK TO THE FUTURE OF BIOLOGY TEACHING IN LEBANON.....	
CHAPTER X A LOOK TO THE FUTURE OF BIOLOGY TEACHING IN LEBANON.....	
1. Suggestions from Students and Teachers.....	183
A. Suggestions made by biology students.....	184
B. Suggestions made by Freshman and Sophomore Students at A.U.B.	185
C. Suggestions made by biology teachers.....	187
2. Recommendations.....	188
PART V SUMMARY AND CONCLUSIONS.....	
1. Summary.....	196
2. Findings.....	199
3. Conclusions.....	203

	Page
APPENDIX	
A. The Questionnaires Submitted to Biology Teachers and Students.....	207
B. The Letters Sent to Secondary Schools..	230
C. Secondary School Biology Requirements of Various Institutions.....	235
D. Examination Papers in Biology.....	245
BIBLIOGRAPHY	266

LIST OF TABLES

TABLE	Page
I Total Number of Points and the Mean of 24 Anglo-Saxon Teachers, 14 Latin Teachers and the Total Group of 38 Teachers in Selecting Aims of Biology Teaching.....	2
II Aims of Biology Teaching which Were Considered More Important than Average by a Significant Proportion of Teachers.....	5
III Aims of Biology Teaching Considered Less Important than Average by a Significant Proportion of Teachers.....	7
IV Aims of Biology Teaching Considered More Important than Average by a Significantly Greater Proportion of Teachers in Anglo-Saxon Type Schools than in Latin Type Schools.....	8
V Numbers and Percentages of 501 Students from Lebanese Secondary Schools Freely Expressing Various Aims of Biology Teaching.....	10
VI Total Numbers of Points and the Mean of 38 Teachers in Anglo-Saxon Type Schools and Latin Type Schools and in Choice of Criteria for the Selection of Subject Matter in Biology.....	35
VII Criteria which Were Considered More Important than Average by a Significant Proportion of Teachers	39

VIII	Criteria Rated Lower than Average by a Significant Proportion of Teachers.....	40
IX	Units of Subject Matter Rated Important by a Significant Proportion of Teachers in Anglo-Saxon Type Schools.....	45
X	Units of Subject Matter Rated Important by a Significant Proportion of Teachers in Latin Type Schools.....	45
XI	Units of Subject Matter Rated Important by a Significant Proportion of Biology Teachers...	46
XII	The Number and the Percentage of Anglo-Saxon and Latin Type School Teachers Who Do Not Teach Certain Units of Biology But Who Nevertheless Consider them Important.....	48
XIII	Names of Biology Textbooks Used in the Secondary Schools in Lebanon.....	49
XIV	Evaluation of Textbooks by the Teachers Who Use them.....	52
XV	Further Evaluations of Biology Textbooks.....	53
XVI	The Grade Level of Biology Instruction in the Secondary Schools of Lebanon.....	55
XVII	Biological Topics of Greatest Interest to 508 Students in Lebanon.....	63
XVIII	The Reactions of 506 Students from Girls', Boys' and Coeducational Schools in Lebanon to the Idea of Sex Education.....	65

XIX	The Responses of 24 Teachers in Anglo-Saxon Schools and 14 Teachers in Latin Type Schools About Their Use of Some Classroom Activities.	114
XX	Responses Given in Percentage of 44 A.U.B. Freshman and Sophomore Students Concerning the Laboratory of Secondary Schools They Attended.	116
XXI	Hours Devoted to Biology Laboratory Periods Per Week in 24 Anglo-Saxon Type Schools and 14 Latin Type Schools.....	117
XXII	The Responses of 24 Teachers in Anglo-Saxon Type Schools and 14 Teachers in Latin Type Schools to Questions About Their Biology Laboratory.....	118
XXIII	The Responses of 24 Anglo-Saxon Teachers and 14 Latin Teachers About the Use of Certain Animals for Dissection.....	120
XXIV	The Interests of About 500 Biology Students in Certain Biological Methods and Activities.....	136
XXV	The Interests of About 100 A.U.B. Freshman and Sophomore Students in Certain Biological Methods and Activities.....	136
XXVI	Some Aspects of Biology Teaching Methods in which a Significant Proportion of Boys are More Interested than Girls.....	139
XXVII	The Teaching Experience of the Biology Teachers Studied.....	169

TABLE	Page
XXVIII Degrees Held by the Biology Teachers Studied	169
XXIX Courses Taken by the Biology Teachers in the Study.....	171
XXX Suggestions Made by About 500 Students for Helping a Person to Become a Good Biology Teacher.....	184
XXXI Suggestions by 97 Freshman and Sophomore Students at A.U.B. for Improving the Teaching of Biology in the Secondary Schools they Attended.....	186
XXXII Suggestions of 38 Biology Teachers for Improv- ing the Teaching of Biology in the Secondary Schools of Lebanon.....	187

LIST OF FIGURES

FIGURE	Page
1. Histograms Representing the Proportion of Teachers Choosing Each Number of the Scale Which Accompanied Each of the Aims of Biology Teaching.....	3
2. Histograms Representing the Proportion of the Teachers Choosing Each Number of the Scale which Accompanied Each of the Criteria for the Selection of Subject Matter in Biology.....	37
3. Histograms Representing the Proportion of the Responses of 24 Teachers in Anglo-Saxon Type Schools and 14 Teachers in Latin Type Schools About the Importance of Some Units of Subject Matter in Biology.....	42
4. Histograms Representing the Proportion of 24 Teachers in Anglo-Saxon Type Schools and 14 Teachers in Latin Type Schools Practising Each Method.....	106
5. Histograms Representing the Quality of the Teaching Procedures in the Biology Classes of 21 Secondary Schools of Lebanon.....	110
6. Histograms Representing the Behavior of Biology Students in the Biology Classes of 21 Secondary Schools of Lebanon.....	112
7. A Floor Plan for a Biology Laboratory.....	193
8. A Plan for Laboratory Tables.....	194
9. A Floor Plan of a Biology Classroom Modified for the Inclusion of Laboratory Activities.....	195

INTRODUCTION

The Problem

The main problem of the present study is to discover what changes, if any, should be made in the entire field of secondary school biology teaching in Lebanon so as to render it more effective in the development of enlightened and capable citizens.

The Method

The problem was treated in the following way:

First, the modern literature about biology teaching was investigated in an effort to obtain a broad general view of biology teaching as it is seen by the foremost thinkers in the field.

Second, the teaching of biology in the secondary schools of Lebanon was investigated directly, in all of its important aspects. For this purpose three different questionnaires were prepared both in English and French. The first was for secondary school biology teachers, the second for biology students of the Freshman and Sophomore classes at the A.U.B. and the third for biology students in secondary schools.¹

The second questionnaire was administered in A.U.B. classes. For the other two it was necessary to pay visits to various secondary schools of Lebanon. For this purpose, a list of 38 representative secondary schools was furnished by Dr. Habib Kurani, Chairman of

1 Appendix A

the Department of Education at A.U.B. The list included the following secondary schools.

<u>Name</u>	<u>Place</u>
1. Al-Ahliya College for Girls	Beirut
2. Al-Hikma (Sagesse) School	Beirut
3. Al-Idha Institute	Beirut
4. Al-Makasid Moslem College for Boys	Beirut
5. Al-Makasid Moslem College for Girls	Beirut
6. American School for Girls	Beirut
7. A.U.B. Preparatory Section	Beirut
8. Armenian Evangelical Central High School	Beirut
9. Armenian Evangelical High School	Beirut
10. College de Ia Salle	Beirut
11. College Des Garcons de L'Union Generale Armenienne de Bienfaissence	Beirut
12. College Laique Francais	Beirut
13. College Protestant Francais des Jeunes Filles	Beirut
14. English High School for Boys	Beirut
15. Lycee Francais	Beirut
16. The Greek Catholic Patriarchal College	Beirut
17. The National Evangelical College	Beirut
18. Middle East College	Boushariya
19. Brummana High School	Brummana
20. Oliver's School and Orphanage	Al-Matn
21. The Lebanese High School for Girls	Shuwaifat

<u>Names</u>	<u>Place</u>
22. National College for Boys	Shuwaifat
23. National College for Girls	Shuwaifat
24. College Universal for Boys	Aley
25. College Universal for Girls	Aley
26. The National Evangelical School	Zahleh
27. American Boys' School for Arts	Sidon
28. American School for Girls	Sidon
29. American School for Girls	Tripoli
30. American School for Boys	Tripoli
31. Government Secondary School for Boys	Tripoli
32. Government Secondary School for Girls	Tripoli
33. Kulliyat at-Tarbiya Wat-Ta'lim for Girls	Tripoli
34. The National Orthodox College	Tripoli
35. Tripoli College for Boys	Tripoli
36. Bishmizzin High School	Bishmizzin
37. The National Kuraniya School	Amyun
38. National College of Marj'uyun	Marj'uyun

Dr. H. Kurani also sent letters to the principals of these schools stating that one of the graduates of the Education Department would visit the schools to have interviews with their biology teachers, and that he would appreciate their cooperation in this matter.¹

The usual procedure for the school visits was as follows:

1 Appendix B, 1

First, after having a short interview with the principal, I was introduced to the biology teacher. After the teacher had become acquainted with the purpose of my visit, a biology class was attended. In the interview after the class a questionnaire was presented to each teacher, who was requested to return it by mail. In most cases several visits or letters were required in order to elicit the finished questionnaires.

Limitations

The investigator has exerted every effort to be as objective as possible, but the following limitations of the techniques used for collecting data must be noted:

1. Some of the items of the questionnaires may be open to the charge of ambiguity.
2. It was assumed that teachers and students answered truthfully and without influence from other persons.

Several terms used in this thesis have been used in the educational literature in widely varying contexts, and their use without explanation is likely to lead to misunderstandings. The following list gives the meanings of these terms as they are used in this thesis.

DEFINITIONS

1. "Modern Educational Thought (Specialists)":

The opinions of educationists in the field of biology and science teaching such as: G. Blaydes, J. Breukelman, U. Cole, T. Green, E. Heiss, Ch. Hoffman, E. Obourn, D. Miller.

2. "Anglo-Saxon and Latin type Schools":

These two types of schools are differentiated on the basis of language. Schools in which the language of instruction is English are considered as Anglo-Saxon type schools, and schools in which the language of instruction is French are considered as Latin type schools.

3. "Significant at the 1% and the 5% levels."

A result at the 1% level means that the difference or disproportion in question could not have arisen by chance sampling from a population where the difference or disproportion is actually nil, except once in 100 such samples. If the 5% level is indicated, one such sample out of 20 might be expected to show the same difference or disproportion when only chance is operating. For researches of this type, the 5% level of significance is widely accepted, and any difference or disproportion found significant at this level is regarded with confidence as indicative of a real difference or disproportion in the population from which the sample was drawn.

PART I

WHY TEACH BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON?

CHAPTER I

THE EXISTING STATUS OF THE AIMS OF BIOLOGY TEACHING IN THE SECONDARY SCHOOLS OF LEBANON

1. The Opinions of Biology Teachers On the Aims of Biology Teaching

To obtain the opinions of biology teachers about the aims of biology teaching, twenty three aims of biology teaching were presented to thirty eight biology teachers of whom 27 were men and 11 were women. Each aim was preceded by eleven consecutive numbers from 0 to 10 representing a scale of importance. The teachers were asked to encircle one of the numbers for each aim. They were asked to encircle zero if they thought that a statement should not be considered an aim of biology teaching. For each aim, the total of the encircled numbers was taken, and the mean of these numbers was calculated. Table I represents the total numbers of points and the mean of each aim.

TABLE I

TOTAL NUMBER OF POINTS AND THE MEAN OF 24 ANGLIO-SAXON TEACHERS (A), 14 LATIN

TEACHERS (L), AND THE TOTAL GROUP (T) OF 38 TEACHERS

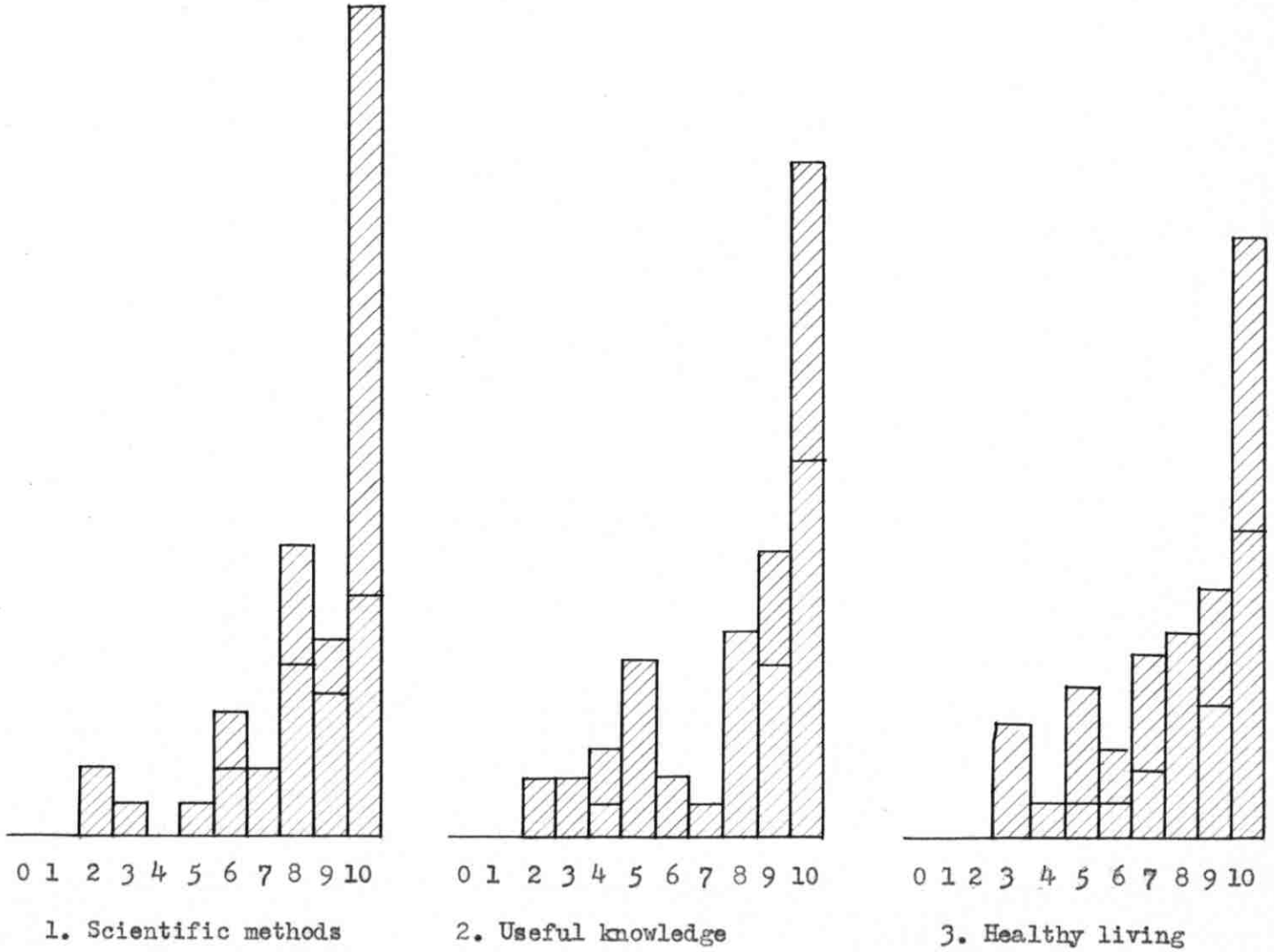
Statements of Aims	Total Points			Means		
	A	L	T	A	L	T
1. To develop the scientific method	184	131	315	7.7	9.4	8.3
2. To impart useful knowledge which might be applied in the daily lives of the students	214	98	312	8.9	7.0	8.2
3. To help the students to learn and practise the principles of healthy living	203	104	307	8.5	7.4	8.1
4. To aid pupils in acquiring biological principles which are common to all living things	192	104	296	8.0	7.4	7.8
5. To develop scientific attitudes	163	114	277	6.8	8.2	7.3
6. To reveal the wonders of Divine Creation whereby the students can appreciate the existence of a Creator	156	100	256	6.8	7.1	6.9
7. To impart a body of factual knowledge about organisms	168	94	262	7.0	6.7	6.9
8. To teach appreciation	160	100	260	6.7	7.1	6.8
9. To develop good habits such as neatness, organization, etc.	151	98	249	6.3	7.0	6.5
10. To help students in acquiring methods of investigation for getting more information in biological sciences	157	86	243	6.5	6.1	6.4
11. To give a good background to the students to ensure their success in university entrance exams or in university course or in official examinations	159	80	239	6.6	5.7	6.3
12. To develop the problem solving ability of the student	130	69	229	5.7	4.9	6.2
13. To develop love and kindness toward organisms	152	80	232	6.3	5.2	6.1
14. To prepare the students for good family life	161	71	232	6.7	5.1	6.1
15. To develop the creative ability of the student	147	73	220	6.0	5.6	5.9
16. To develop the right attitude toward the conservation of natural resources	140	76	216	6.1	5.4	5.9
17. To train the students in technical skills	153	63	216	6.6	4.5	5.8
18. To develop an interest for a vocation in biology	140	82	222	5.8	5.9	5.8
19. To develop vocational interests.....	141	76	217	5.9	5.6	5.7
20. To develop socially desirable attitudes	127	85	212	5.3	6.1	5.6
21. To develop the ability of students in drawing	88	34	122	3.4	2.4	3.2
22. To develop the ability of students in note-taking	80	34	114	3.3	2.4	3.0
23. I teach it as a profession to earn my living	44	44	88	2.0	3.4	2.5

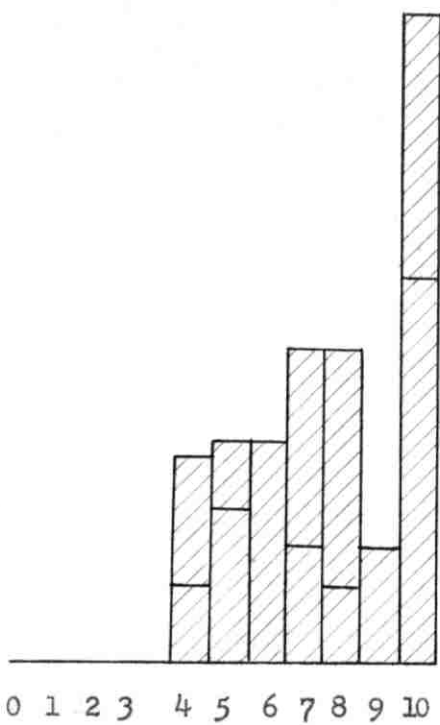
The histograms in Figure I represent the proportion of the teachers choosing each number of the scale. To illustrate the relations obtaining between the aims of the twenty four teachers in Anglo-Saxon type schools and the fourteen teachers in Latin type schools, the histograms are drawn proportionally—that is, each group of teachers occupies the same area.

FIGURE I

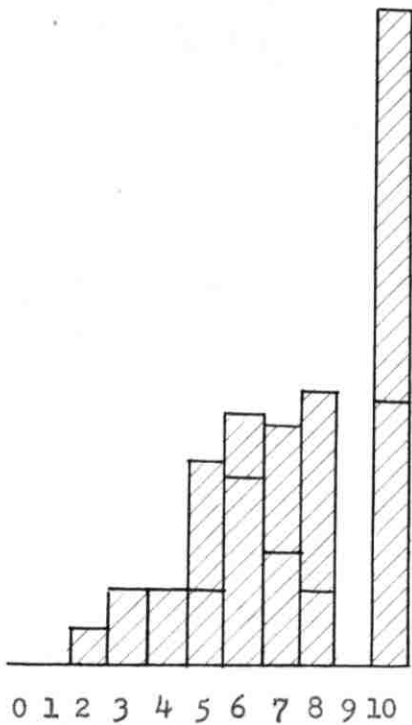
Histograms Representing the Proportion of Teachers Choosing
Each Number of the Scale Which Accompanied Each of the
Aims of Biology Teaching

Red - Anglo-Saxon Blue - Latin

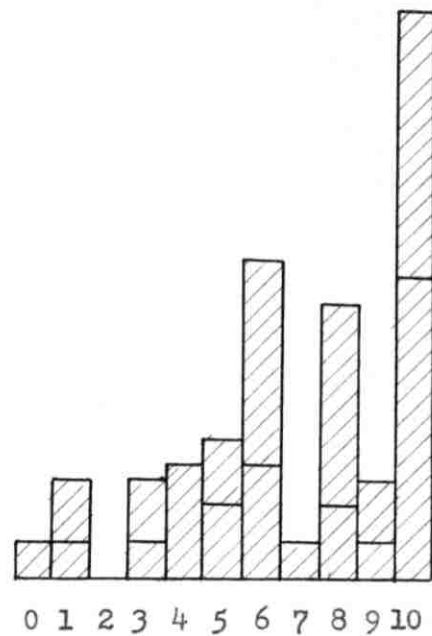




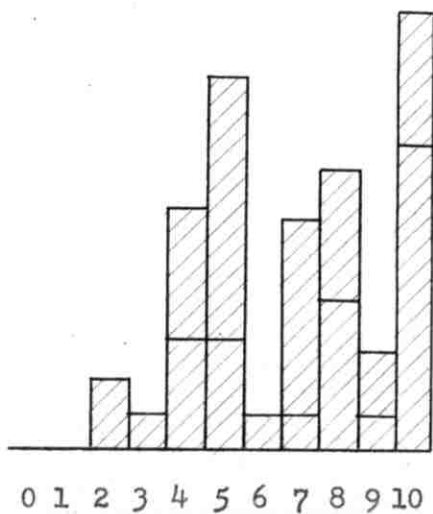
4. Biological principles



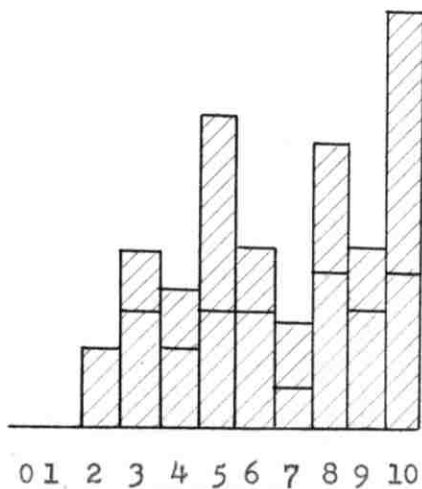
5. Scientific attitudes



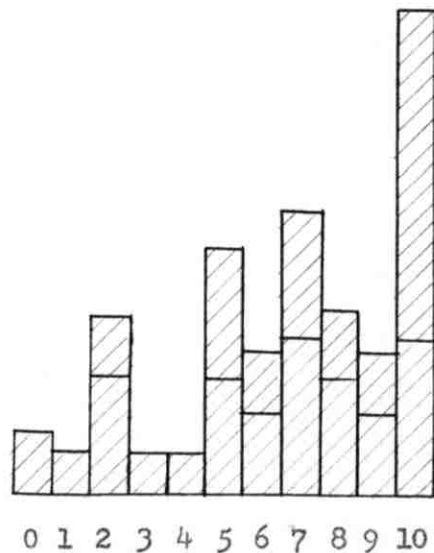
6. Existence of God



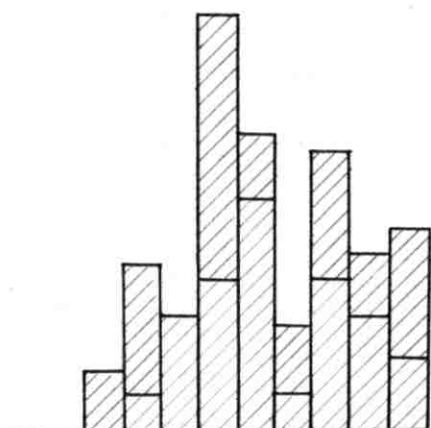
7. Factual knowledge



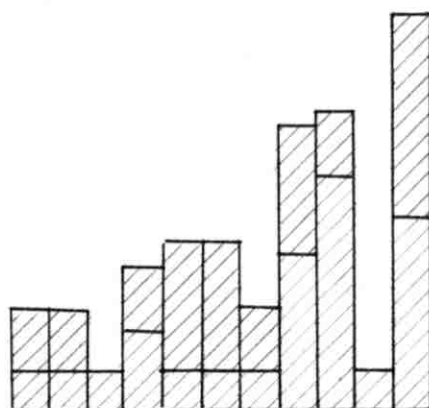
8. Appreciation



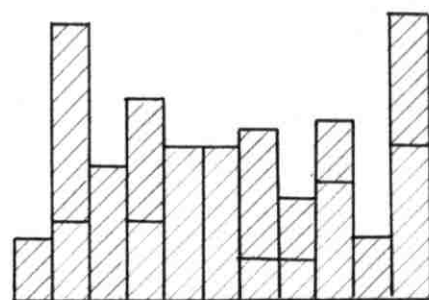
9. Good habits



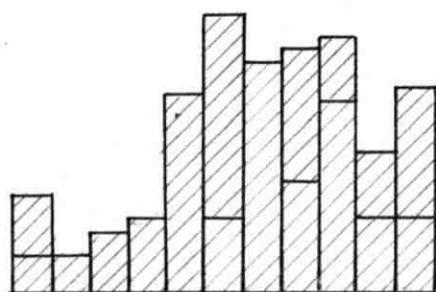
0 1 2 3 4 5 6 7 8 9 10
10. Methods of investi-
gation



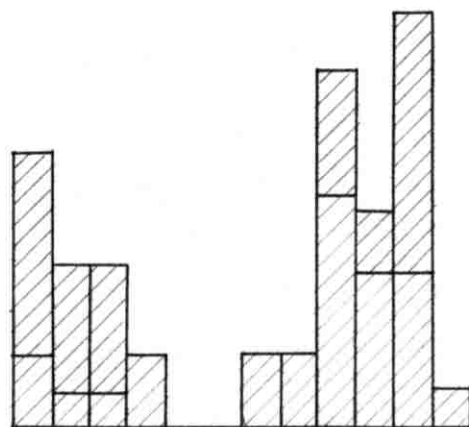
0 1 2 3 4 5 6 7 8 9 10
11. Success in exams



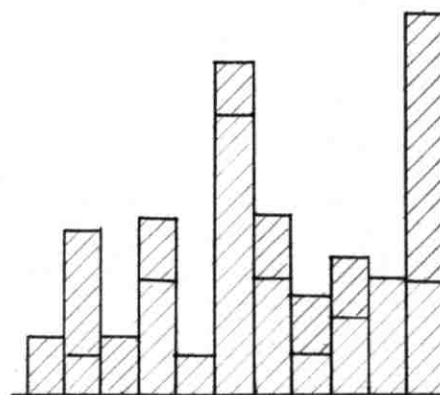
0 1 2 3 4 5 6 7 8 9 10
12. Problem solving



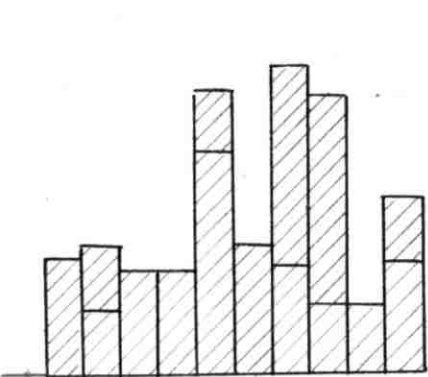
0 1 2 3 4 5 6 7 8 9 10
13. Love toward organ-
isms



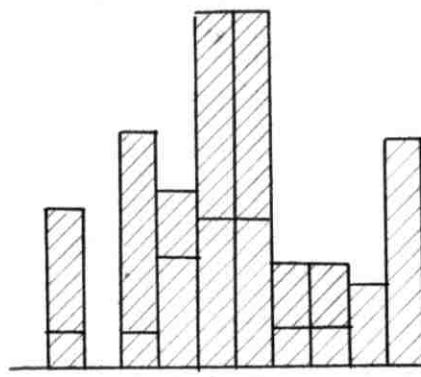
0 1 2 3 4 5 6 7 8 9 10
14. Family life



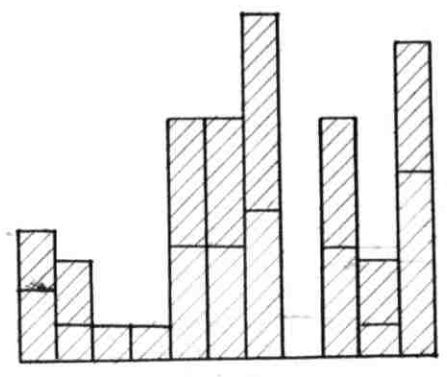
0 1 2 3 4 5 6 7 8 9 10
15. Creative ability



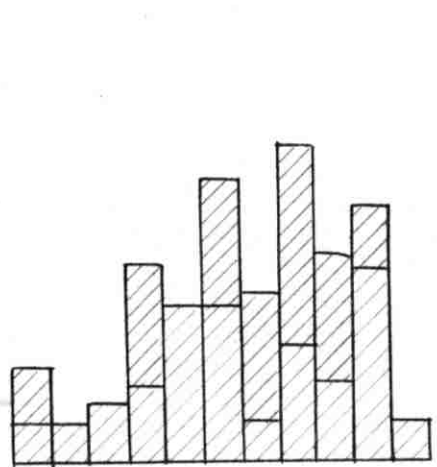
16. Conservation



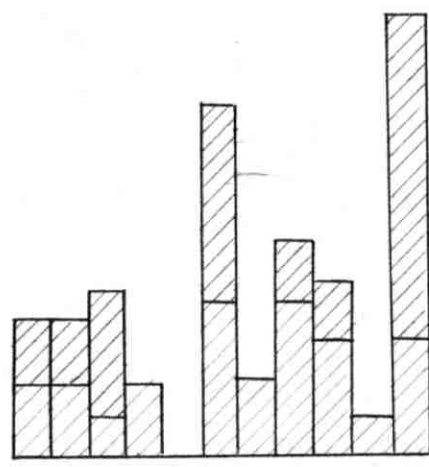
17. Technical skills



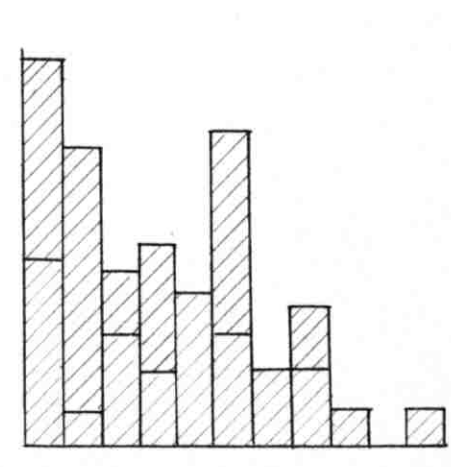
18. Vocation



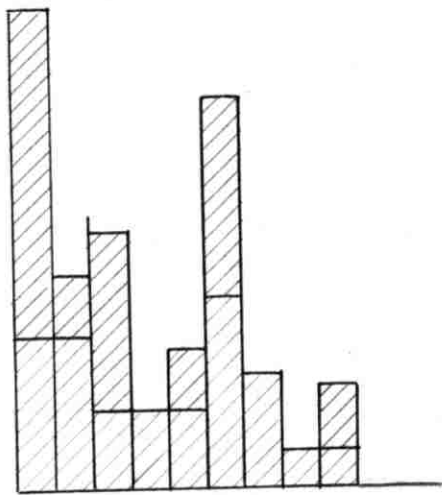
19. Avocational interests



20. Social attitudes

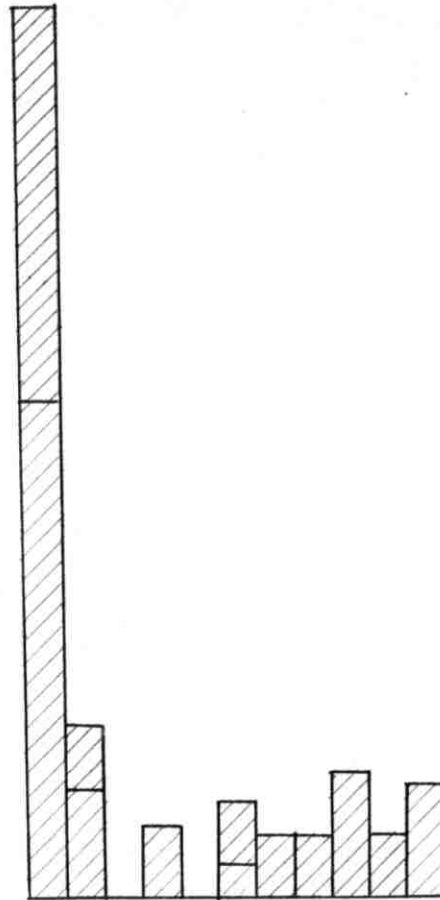


21. Drawing



0 1 2 3 4 5 6 7 8 9 10

22. Note-taking



0 1 2 3 4 5 6 7 8 9 10

23. Earning a living

Biology teachers do not generally agree on the importance of all of the aims. Some of the aims are considered more important by one or the other of the groups. Table II represents the aims which are considered most important. This ranking is based on the following technique:

The average number given by each teacher is found by dividing the sum of the numbers he gave to all the aims by the total number of aims. It was then determined how many times an aim was ranked below or above the average number given by each teacher. After testing for the significance of each deviation from chance expectancy, the aims were arranged in decreasing order of importance. The aims bearing two asterisks are significant at 1% level¹, those bearing one asterisk are significant at 5% level; that is, an aim bearing two asterisks was found to be above the means of the teachers' ratings in a significant number of cases, which means that the disproportion could not have occurred by chance more than once in 100 such questions; in the case of the aims bearing one asterisk, the disproportion could not have occurred by chance more than five times in 100 such questions.

¹ Note: All through the thesis, statements bearing two asterisks are significant at the 1% level, and those bearing one asterisk are significant at the 5% level.

TABLE II

AIMS WHICH WERE CONSIDERED MORE IMPORTANT THAN
AVERAGE BY A SIGNIFICANT PROPORTION OF
TEACHERS

A. Teachers in Anglo-Saxon Schools.

1. ** To impart useful knowledge which might be applied in the daily lives of students.
2. ** To develop the right attitude toward the conservation of natural resources.
3. ** To help the students to learn and to practise the principles of healthy living.
4. ** To help students in acquiring methods of investigation for getting more information in biological sciences.
5. * To aid pupils in acquiring biological principles which are common to all living things.

B. Teachers in Latin Type Schools.

1. ** To develop the scientific method.
2. ** To develop scientific attitudes.

C. Teachers of Lebanon in General.

1. ** To develop the right attitude toward the conservation of natural resources.
2. ** To help the students to learn and practise the principles of healthy living.

3. ** To impart useful knowledge which might be applied in the daily lives of students.
4. ** To develop scientific attitudes.
5. ** To aid pupils in acquiring biological principles which are common to all living things.
6. * To help students in acquiring methods of investigation for getting more information in biological sciences.

Table III represents the aims which are considered less important than average by a significant proportion of teachers.

TABLE III

AIMS CONSIDERED LESS IMPORTANT THAN AVERAGE BY A SIGNIFICANT
PROPORTION OF TEACHERS

A. Teachers in Anglo-Saxon Schools.

1. ** To develop the ability of students in drawing.
2. ** To teach it as a profession to earn a living.
3. ** To reveal the wonders of Divine Creation whereby the students can appreciate the existence of a Creator.

B. Teachers in Latin Schools.

1. ** To develop the ability of students in drawing.
2. ** To develop the ability of students in note-taking.
3. ** To train students in technical skills.

C. Teachers of Lebanon in General.

1. ** To develop the ability of students in drawing.
2. ** To teach it as a profession to earn a living.
3. * To develop the ability of students in note-taking.
4. * To reveal the wonders of Divine Creation whereby the students can appreciate the existence of a Creator.

Table IV represents the aims which are considered more important than average by a significantly greater proportion of teachers in Anglo-Saxon type schools than the proportion in Latin type schools.

TABLE IV

AIMS WHICH ARE CONSIDERED MORE IMPORTANT THAN AVERAGE BY
A SIGNIFICANTLY GREATER PROPORTION OF TEACHERS IN
ANGLO-SAXON TYPE SCHOOLS THAN THE PROPORTION IN
LATIN TYPE SCHOOLS

A. Aims considered more important by teachers in Anglo-Saxon type schools than by teachers in Latin type schools:

1. ** To train the students in technical skills. Such as dissecting animals, setting apparatus, collecting and preserving animals.
2. * To give a good background to the students to ensure their success in university examinations or in university courses or to pass official examinations (Baccalaureate).
3. * To impart useful knowledge which might be applied in the daily lives of students.

B. Aims considered significantly more important by teachers in Latin type schools than by teachers in Anglo-Saxon type schools:

1. ** To develop the scientific method.
2. * To reveal the wonders of Divine Creation whereby the students can appreciate the existence of a Creator—God.

2. The Opinions of Biology Students on the Aims of Biology Teaching.

The preceding tables give an idea about the aims of biology teaching as they are seen by biology teachers. It was felt that it would be useful to know what biology students thought. To discover why students take biology, the direct question "Why do you study biology?" was asked to 501 biology students, without an answer being suggested. Their responses are classified in Table V. Some students gave more than one reason.

It should be noted that there is a notable difference between the aims chosen by biology teachers and those reported by students. Also, analysis of the responses of girls and boys failed to demonstrate any statistically significant sex difference in reasons given for studying biology.

TABLE V

FREQUENCY AND PERCENTAGE OF 501 STUDENTS FROM VARIOUS SCHOOLS FREELY EXPRESSING VARIOUS AIMS IN ANSWER

TO THE QUESTION "WHY DO YOU STUDY BIOLOGY?"

Statement of Aims	Number of Re-sponses from Students in Girls' Sch.		Number of Re-sponses from Students in Boys' Schools		Number of Re-sponses from Students in Co-ed. Sch.		Total
	Freq.	%	Freq.	%	Freq.	%	
1. Because I want a knowledge about animals, plants, and the human body.	41	48	112	51.0	140	55.0	293
2. Because I am obliged by the program of the school.	21	25.0	43	20.0	57	22.0	121
3. Because I am interested and like it.	16	19.0	36	16.0	35	13.0	87
4. Because I want to be a doctor.	0	0	17	7.5	9	3.5	26
5. Because I consider it to be an important subject.	3	3.5	5	2.3	10	4.0	18
6. Because I want to be familiar with the scientific method so as to be able to make a discovery.	4	4.5	5	2.3	3	1.7	12
7. Because I want to study agriculture.	0	0	2	0.9	0	0	2
8. Because I want to improve my English.	0	0	0	0	2	0.8	2
Total number of responses given by students in girls' schools					85		
Total number of responses given by students in boys' schools					220		
Total number of responses given by students in co-ed. schools					256		
Total number of responses given by students in all schools					561		

SUMMARY

There is some agreement on the aims of biology teaching by the biology teachers of Lebanon. For most of the aims, responses are found to be spread all along the scales. Typical examples are the histograms of the aims numbered 8, 10, 12, 13, 14, 15, 16, 18, 19, 21. In some cases teachers in the same type of school have markedly different ideas.

In general teachers in Anglo-Saxon schools gave more importance to the needs, interests and the social life of students while teachers in Latin type schools gave more importance to the development of the minds of students. There is a notable difference between the aims chosen by biology teachers and those reported by students. While the aim "To impart a body of factual knowledge" is not a significant aim¹ among the teachers, it is by far the outstanding aim of the majority of students. Many biology students have not seen the real value to them of a course in biology; one student in every five takes the course under obligation.

Statistical analysis failed to reveal a significant difference between boys and girls as regards their aims in taking courses in biology.

¹ "Significant aim" as used here, means an aim considered above average in importance by a significant proportion of teachers.

CHAPTER II

THE AIMS OF BIOLOGY TEACHING IN MODERN EDUCATIONAL THOUGHT

Modern educational specialists use certain criteria to select and to evaluate their activities.

The criteria for the selection of the aims of biology teaching in modern educational thought are the following:

1. Being a subject of instruction, its aim must be determined in conformity with the general aims of education.
2. Being a science, its aim must be determined by the general aims of science teaching.
3. Being taught in secondary schools, its aims must be determined by the general aims of secondary schools.
4. Being taught in Lebanon, its aim must be determined by the philosophy of education of Lebanon.

These criteria are far from being absolute and independent. In their turn they themselves are determined by other criteria, and they are often complementary. However, a brief discussion of each of them is useful in facilitating the selection of those aims of biology teaching which are most appropriate for the secondary schools of Lebanon.

1. The Aim of Education

For the human being the beginning of his life is the beginning of his education, and the end of his life is the end of his education. Life and education are one with each other, they are mutually determined and mutually effected.

The life of an individual is the process of interaction of his nature with his environment, therefore the nature of his life is determined by the nature of his environment and by his human nature.

The nature of the environment is dynamic: it is the sum total of stimuli which move the individual to respond. The stimuli may be physical, psychological, or as in most cases, the interaction of both in a highly complex form.

Human nature is dynamic; it is a state of change and growth. It is equipped with inherent potentialities which have a physical basis. The genes, the nervous system, the glands, the physiological functions, etc., are the equipment of an individual.

One of the characteristics of human nature is the existence of needs, both inherent and acquired. The life of an individual is the process of satisfying these needs by the interaction of his potentialities with the environment. Since the nature of the environment is complex and evolving, the human being left with only an undeveloped, innate capacity may not be able to produce the necessary adjustments.

Fortunately, human nature is modifiable. The potentialities can be developed to produce the necessary adjustments. The measures taken to develop human nature in order that it may be able to make adjustments is education. Therefore education, in general, may be said

to be the process of the modification of the factors involved in a problematic situation, so as to attain adjustment. This implies that either the environment or human nature may be modified to bring about the adjustment.

The life of an individual is a conscious or unconscious endeavor to satisfy his needs to attain adjustments. At any moment, his state is the sum total of the consciousness of the satisfaction of some needs, the consciousness of the existence of some unsatisfied needs, the consciousness of his endeavor to satisfy the needs, and the unconscious satisfaction of many other needs. Life is complex because the satisfaction of the needs is complex. Some needs, when satisfied, produce permanent adjustments, but others may produce temporary adjustments, and still others may produce additional needs. Even during the process of satisfaction of a need, the adjustments of other needs are distorted. Life is the expression of highly complex adjustments and maladjustments.

The term "adjustment" implies:

- a. The existence of needs. The recognition and evaluation of physical, mental, and spiritual needs.
- b. The process of satisfying the need. Proper selection of the needs to be satisfied and the proper process of satisfying the needs. The development of an individual's potentialities insures the increased efficiency of this process.
- c. An adjusted state. The term state, does not mean a static condition, a piece of cast iron, but a condition in which the individual feels a temporary satisfaction. The adjusted state is a dynamic condition in

which the individual may consciously shift either to more and more satisfaction or back to the original need.

A person with fixed, rigid values and ideals, while he may seem to be adjusted in a satisfactory way, is far from being an educated person. Another person, whose values, ideals and aspirations are all in a dynamic state of evolution may be, and often is, an educated person.

The satisfaction felt by recognition of an adjusted state is a common one, but the satisfaction due to the revelation of higher needs through the adjustment of the more ubiquitous ones is genuine satisfaction. B.A. students should not begin to study for an M.A. degree if their intention is to have more of their problems in the realm of thought solved. New problems will arise which will distort even their apparently satisfactory former adjustments. Those students who enjoy dealing with problematic situations and who appreciate states of confusion, exhibiting an eagerness to find solutions, are truly candidates for more education, and for post-graduate studies.

I suggest the use of the term "equilibrium" instead of the word "adjustment" because the former better implies a state of dynamic action. In this usage the needs may be called tensions distorting the equilibrium of a person. Satisfying a need will be the removal of the tension to establish an equilibrium with the need. An educated person continually establishes equilibria among the complex tensions of life. For him the process of removing a tension and establishing an equilibrium is a cyclic one. One begets the other in a never-ending fashion. Thus he establishes an equilibrium; the formation of the equilibrium produces new tensions;

by virtue of his education he removes the new tensions, but the equilibrium produced reveals still newer tensions, and so on. Thus this dynamic state of progressive equilibria results in genuine growth. Growth is the fruit of education.

But what criteria are needed to consider the removal of a need an "adjustment," and the succession of adjustments genuine growth? What factors should determine the direction of growth?

The value of growth is not in its quantitative increase but rather in its kind. The direction of growth is the real criterion of its value. It is truly said, "Unless we know where we are going there is not much comfort in being assured that we are on the way and travelling fast."

Then what is the criterion which determines the desirable direction of growth?

A boy may consider his act a proper adjustment, but his parents may not consider it so. A person may feel himself adjusted, but his society may not think him so. A society may regard one of its members as being adjusted, but another society may consider the same person maladjusted. A thing which might have been called adjustment ten years ago is called maladjustment now. What, then is the criterion of genuine adjustment and growth?

Some say, let the dimensions of your skin increase so as to include your friend, your society and if possible all the nations. To the extent that your adjustments adjust the society to its ideals, to that same extent your adjustments will be genuine, and the succession of the adjustments will constitute the desirable direction of growth.

Others say, expand your skin a little further to include the supernatural also. By how far your earthly adjustments adjust you to an eternal life, a life after death, to that degree your adjustments will be genuine, and the succession of your adjustments will constitute a desirable direction of growth.

The identification of desirable directions of growth needs deeper analysis and research than is possible within the scope of our thesis. It is hoped that in future someone will undertake an interesting research about it. What is pointed out here is the fact that the direction of growth or the ultimate aim of education is of the same nature as education itself. It has been evolving through the ages. Therefore the suggestion of a fixed goal is not appropriate, because "The search for truth is better than the possession of truth, and to travel hopefully is better than to arrive."¹ However, the following lines of reasoning may be useful in the selection of the aims of biology teaching:

1. Life is full of needs and some of them are biological, such as the need for a healthy body, the need for first aid in emergency cases, the need for proper attitudes toward and information about members of the opposite sex, the need for proper guidance in illness, etc.

2. Education is intertwined with life. It is not an end but a means to prepare students for life, both now and in the indefinite future. If education considers the whole range of needs, the biological needs fall within the scope of biology teaching.

1 Raymond, T. Modern Education, Its Aims and Methods, fourth ed. (London, 1953) p. 36.

2. Aims of Science Teaching

Modern educational thinkers consider the main aim of science teaching to be the development of the ability of students to apply the scientific method. Scientific method is not a process of doing something, it is a thinking process, useful in finding solutions to perplexing problems. The thinking process may suggest the need for doing some experiments, but essentially it is a way of thinking and not a way of doing. It has been truly said that if science teaching is to serve its greatest possible function, it must train young people to think.

Some authors attribute certain steps to the scientific method, such as: The process of observation to collect data, the process of classifying the data, the process of correlating the data and the process of generalization and verification. But actually these are not fixed criteria by which we may call a method scientific. A scientific treatment of a problem may sometimes be undertaken without collecting observable data and doing experiments. Through vigorous thinking useful theories have been established.

The development of scientific methods and attitudes are not the only objectives of scientific teaching.

Perhaps the objectives of science teaching have been presented most satisfactorily by the National Society for the Study of Education, and W.C. Van Deventer, as follows:¹

A - Functional Information or facts about such matters as:

1. Our universe - earth, sun, moon, stars, weather, and climate.
2. Living things - plants and animals.

1 Nelson, Henry B. (ed.), National Society for the Study of Education, 46th yearbook, (Chicago, 1947).

3. The human body - structure, functions and care.
4. The nature of matter, elements, compounds, mixtures, chemical change, physical change, solids, liquids, gases.
5. Energy - sources, types of energy, machines.
6. Contribution of science to the life of our times - radio, telephone, telegraph, electric lights, motion picture, household appliances and airoplanes.

B - Functional Concepts, such as:

- a. Space is vast.
- b. The earth is old.
- c. All life has evolved from simpler forms.
- d. All matter is probably electric in nature.

C - Functional Understanding of Principles, such as:

- a. All living things reproduce their kind.
- b. Changes in the seasons and differences in weather and climate depend largely upon the relation of the earth to the sun.
- c. Energy can be changed from one form to another.
- d. All matter is composed of single elements or combinations of elements.
- e. Living things in a given environment or locality are mutually interdependent.

D - Instrumental Skills, such as ability to:

- a. Read science content with understanding and satisfaction.
- b. Perform fundamental operations with reasonable accuracy.
- c. Perform simple manipulatory activities with science equipment.
- d. Read maps, graphs, charts, and tables and be able to interpret them.
- e. Make accurate measurements, readings, titrations, etc.

E - Problem Solving Skills, such as ability to:

- a. Sense a problem.
- b. Define the problem.
- c. Study the situation for all facts and clues bearing upon the problem.
- d. Make the most tentative explanations or hypotheses.
- e. Select the most likely hypothesis.
- f. Test the hypothesis by experimental or other means.
- g. Accept tentatively, or reject the hypothesis and test other hypotheses.
- h. Draw conclusions.

F - Attitudes, such as:

- a. Open-mindedness - willingness to consider new facts.
- b. Intellectual honesty - scientific integrity, unwillingness to compromise with truth as known.
- c. Suspended judgment - scientific control, withholding conclusions until all available facts are collected, and not generalizing from insufficient data.
- d. Belief in:
 1. Consistency. The behavior of the universe is describable in terms of consistent laws.
 2. Uniformity. The forces which are now operating in the world are those which have always operated.
 3. Causality. Every phenomenon results from a discoverable cause.
 4. Dynamism. Nature is dynamic rather than static; there is constant variation and change.

5. Relativeness. The phenomena of nature are sets of relationships rather than absolutes.
6. Continuous Discovery. It will be possible to go on learning more and more about the material world and the material universe of which it is a part, until eventually all may be understood.

G - Interests, such as:

- a. Interest in some phase of science as a recreational activity or hobby.
- b. Interest in science as a field for a vocation.

H - Appreciations, such as:

- a. Appreciation of the contributions of science tests.
- b. Appreciation of basic cause-and-effect relationships.
- c. Sensitivity to possible uses and applications of science in personal relationships and dispositions to use scientific knowledge and abilities in such relationships (attitudes).

3. Aims of Secondary Schools

Secondary school education is the link between primary and college education, for many students. For others it is the end of formal schooling. Some of its aims overlap those of primary schools and colleges, but some are unique.

The following constitute the essentials of secondary school aims in general:

- A - To increase the knowledge of students about their environment.
 - a. About the atmosphere and heavenly bodies.

- b. About the composition of the earth.
- c. About the regions of the earth.
- d. About the forces of nature.
- e. About the composition of matter.

B - To train students in certain skills:

- a. In reading.
- b. In writing.
- c. In talking and listening.
- d. In manipulative work.

C - To develop proper attitudes:

- a. Towards parents.
- b. Towards family ideals.
- c. Towards friends.
- d. Towards organisms.

D - To develop desirable communication:

- a. The acquisition of languages.
- b. The acquisition of etiquette.
- c. The acquisition of sincere social life.
- d. The acquisition of loyal citizenship.

E - To develop the ability of objective thinking:

- a. To apply deductive and inductive methods.
- b. To observe facts and suspend judgment.
- c. To generalize correctly.
- d. To verify objectively.

F - To develop the affective nature of students.

- a. To appreciate art.
- b. To sympathise with the weak.
- c. To control his emotions.
- d. To select and evaluate values.

G - To develop the rules of healthy living:

- a. To take care of the body.
- b. To take care of patients.
- c. To select balanced diets.
- d. To appreciate public health programs.

H - To use leisure time properly:

- a. To develop good hobbies.
- b. To appreciate exercises and sports.
- c. To appreciate music and literature.

I - To prepare for life after graduation:

- a. To meet the requirements of local colleges.
- b. To ensure the success of students in university life.
- c. To create an aptitude for advanced learning.
- d. To give guidance for the selection of an occupation.

4. The Philosophy of Education of Lebanon

A country like Lebanon, because of the nature of its culture, heritage, people, social, political, economic and religious structure, should have a particular philosophy of education. But today Lebanon is suffering from a philosophical crisis, and one of its main problems is the lack of a coherent philosophy of education.¹ Antippa² discusses

1 Antippa, F., Philosophy of Education for Lebanon. Unpublished thesis, p. 185.

2 Ibid. p. 177.

fully the criteria for the synthesis of a philosophy of education and proposes the progressivist's philosophy of education for Lebanon.

The progressivist's philosophy of education is based on the following philosophical pillars:¹

- a. The human being is born good, and human nature is dynamic, active and changing. It is provided with modifiable potentialities, impulses and instincts rather than with faculties. Will is not a datum and mind is not a separate faculty from the physical body.
- b. The world is a universe and not a multiverse. It is always changing and evolving. Novelty is genuine. Relativity is all important in the world.
- c. Reality depends upon the nature of man and time. It is not fixed but is constantly changing, therefore it is not predictable.
- d. Values depend upon the nature of man and on time. They are evolving and dynamic. There are no intrinsic, objective and ultimate values. They are determined by their use in a situation. Therefore a hierarchy of values cannot be set up.
- e. Truth is not fixed and immutable, it depends upon its workability. Therefore it does not exist but happens.
- f. The nature of the human being, the nature of the world, the nature of reality, the nature of values and the nature of truth are internally related. They are not separate and independent entities but are closely interdependent. A change in one produces a change in the others.

1 Adapted from J.S. Brubacher, Modern Philosophies of Education, Second ed. (New York, 1950), pp. 22-71.

The educational implications of these philosophical discussions are:

- a. The curriculum of the school must be flexible. There must not be "essentials" in the curriculum. It must be continually modified and adjusted to the needs of students.
- b. The potentialities of each student must be developed to their fullest extent. Since potentialities differ in different students, individual differences must be taken into consideration.
- c. Since truth does not abide in a particular area, the whole child must be developed. Also the development must take into consideration the social life of the individual. Individualization and socialization must go hand in hand.
- d. Since novelty is a genuine characteristic of the existence of life, the educative process must be problematic and closely related to the lives of students.
- e. Since learning occurs not just from the neck up, but from the neck down as well, the educative process must be based on activity, and the activities must be carried in the vehicle of the interest, motivation and the need of the student.

SUMMARY

In the present chapter four criteria are taken into consideration for the selection of the aims of biology teaching in the secondary schools of Lebanon:

1. The aims of education.
2. The aims of science teaching.
3. The aims of secondary schools.
4. The philosophy of education of Lebanon.

The implications of the above-mentioned criteria are:

1. Since education is to prepare the students for life, biology teaching should consider the biological needs of students in life.
2. Since life is characterized by novel and problematic situations, biology teaching should consider the ability of students to use scientific methods.
3. Since life has many phases, the teaching of biology should aim at the development of the whole child.

CHAPTER III

WHAT SHOULD BE THE AIMS OF BIOLOGY TEACHING IN THE SECONDARY SCHOOLS OF LEBANON?

1. Comparison of the Aims of Biology Teaching as Seen by Biology Teachers and Students in Lebanon and by Modern Educational Specialists

It has been shown that the existing aims of biology teaching in Lebanon as determined by thirty eight teachers are in some respects in agreement with the aims which have been accepted in modern educational thought. The aims on which there is agreement should be maintained and reinforced as aims of secondary school biology in Lebanon. The following are such aims:

- a. Modern educational thinkers and teachers in 24 Anglo-Saxon type schools agree that one of the aims of biology teaching should be to help students to make more satisfactory adjustments to the needs of life.
- b. Modern educational thinkers and teachers in 24 Anglo-Saxon type schools agree that students should be trained in methods of investigation so that they may continue to add to their knowledge in biological sciences.
- c. Modern educational thinkers and teachers in 24 Anglo-Saxon type schools agree that biology students should be trained to acquire desirable attitude towards organisms and natural resources.

- d. Modern educational thinkers and teachers in 14 Latin type schools agree that one of the aims of biology teaching should be the development in the students of scientific methods and attitudes.
- e. Modern educational thinkers and the biology teachers in 38 schools of both Latin and Anglo-Saxon types in Lebanon appear to agree that the acquisition of factual subject matter is a means and not an end.
- f. Modern educational thinkers and 38 biology teachers in Lebanon agree that the following either should not be aims of biology teaching, or are the least important of such aims.
1. To train the students in drawing.
 2. To train the students in note-taking.
 3. To provide an opportunity for teachers of biology to earn a living.

The following is a list of the aims of the teachers in this study which were not in accord with modern educational thought:

- a. The training of students in scientific methods and attitudes is considered more important in modern educational thought than it is by 24 teachers in Anglo-Saxon type schools.
- b. The social development and the adjustment of students to their life needs is considered more important in modern educational thought than it is by 14 teachers in Latin type schools.
- c. Modern educational thinkers pay more attention than 38 teachers in secondary schools of Lebanon to the aims of biology teach-

ing as conceived by biology students. They believe that the progress of biology students depends upon their conception of the aims they pursue.

2. Recommendations of Appropriate aims of Biology Teaching for the Secondary Schools of Lebanon

Aims of biology teaching for the secondary schools of Lebanon should be recommended with considerable caution. The reader should bear in mind that the recommended aims are in no way fixed. Some or all of them may change in time. Since the secondary schools of Lebanon are not identical in all respects, but vary in their locations, philosophies and social structures, the recommended aims cannot be expected to apply equally well to all of them.

The aims will be suggested in three groups:

- a. Primary aims. These are basic aims of biology teaching. It is felt that biology, more than any other subject in the curriculum, is in the position of being best able to fulfill these aims.
- b. Secondary aims. These are more general than the primary aims. Other subjects in the curriculum may contribute as much or more than biology to their achievement.
- c. Associate aims. Strictly speaking these are not aims but they are given some importance because they are associated either with primary or secondary aims, and tend to reinforce them.

The groups are not and cannot be clear-cut. They are interdependent.

RECOMMENDED AIMS OF BIOLOGY TEACHING FOR THE SECONDARY SCHOOLS OF LEBANONA. Primary Aims

I. To develop the ability of the student to meet effectively the biological needs of life, namely:

1. The ability to apply the rules of healthy living.
2. The ability to control the common diseases.
3. The ability to select a proper diet.
4. The ability to form good social relations.
5. The ability to control the growth of organisms.

II. To develop the ability of the students to apply scientific methods and to acquire the attitudes of scientists, namely:

1. The ability to detect and define a problem.
2. The ability to form possible hypotheses for the problem.
3. The ability to collect, classify and correlate data.
4. The ability to interpret the data and to generalize.
5. The ability to evaluate generalizations.

B. Secondary Aims

I. To develop the interest of the students:

1. In a biological vocation.
2. In a phase of biology for the wise use of leisure.
3. In biological research and literature.

II. To develop appreciation of:

1. The nature of biological phenomena.
2. The nature of science and scientific methods.
3. The lives of biologists.

III. To develop desirable attitudes toward:

1. The conservation of biological resources.
2. Animals and plants.
3. Social life, specifically to develop cooperation and responsibility.

C. Associate Aims

I. To impart a body of factual knowledge about:

1. Plants.
2. Animals.
3. The human body.

II. To provide students with skills, such as:

1. Dissecting organisms.
2. Setting up and manipulating laboratory apparatus.
3. Collecting, culturing and preserving organisms.

SUMMARY

Chapter I presented data which described the existing status of the aims of biology teaching in the secondary schools of Lebanon according to biology teachers. There is some degree of agreement on aims among the biology teachers as a whole. Teachers in Anglo-Saxon type schools give more importance to the needs of students in their daily lives, while teachers in Latin type schools give more importance to the mental development of students. There is a notable difference between the aims chosen by biology teachers and those reported by biology students: teachers aim at the acquisition of methods and attitudes, while students aim at the acquisition of subject matter.

Chapter II presented modern educational thought about the aims of biology teaching. It discussed four criteria for the selection of the aims of biology teaching: the aims of education, the aims of science teaching, the aims of secondary schools and the philosophy of education of Lebanon. These criteria suggested that Lebanon's youth should be trained to adjust themselves to the needs of life, and that biology can promote the adjustment of students by training them in functional biological subject matter and in scientific methods and attitudes.

Chapter III attempted to bring together comparable ideas from the preceding two chapters so as to be able to recommend desirable aims of biology teaching in the secondary schools of Lebanon. It was found that modern educational thinkers were in agreement with teachers in Anglo-Saxon type schools about the daily life needs of students, and with teachers in Latin type schools about the development of scientific methods and scientific attitudes. The recommended aims urge the biology teachers of Lebanon to give equal importance to these two aims.

PART II

WHAT SHOULD BE TAUGHT IN BIOLOGY IN THE
SECONDARY SCHOOLS OF LEBANON?

CHAPTER IV

THE EXISTING STATUS OF THE SUBJECT MATTER OF BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON

1. The Opinions of Biology Teachers on the Importance of Some Criteria for the Selection of Subject Matter in Biology

To obtain the opinions of biology teachers about the criteria for the selection of subject matter of biology, eight criteria were presented to 38 biology teachers, who were asked to express their opinions about the importance of each one of them. Each criterion was preceded by eleven consecutive numbers representing a scale of importance. The teachers were asked to encircle one of the numbers for each aim. They were asked to encircle zero if they thought that a stated criterion should not be considered as a criterion for the selection of subject matter in biology.

For each aim, the total of the encircled numbers was taken, and the mean of these numbers was calculated. Table VI represents the total number of points and the mean of each aim.

TABLE VI

TOTAL NUMBER OF POINTS AND THE MEAN OF 24 TEACHERS IN ANGLIO-SAXON TYPE SCHOOLS (A),
14 TEACHERS IN LATIN TYPE SCHOOLS (L) AND THE TOTAL GROUP (T) OF 38 TEACHERS

IN CHOICE OF CRITERIA FOR THE SELECTION OF SUBJECT MATTER IN BIOLOGY

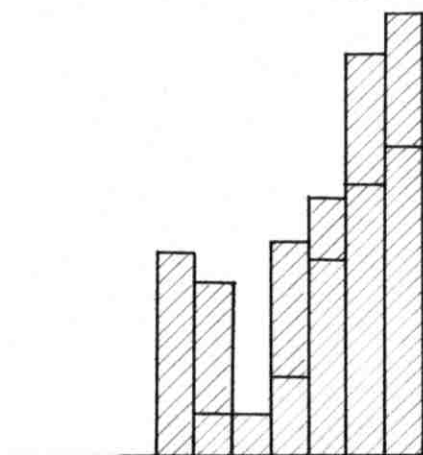
Statement of Criteria	Total Points			Means		
	A	L	T	A	L	T
1. The usefulness of the subject matter in the lives of the students.	208	82	290	87	68	81
2. The adaptability of the subject matter to the learner's stage of mental maturity.	202	91	292	84	76	81
3. The adaptability of the subject matter to the interest of the students.	135	91	276	77	76	77
4. The values of the subject matter to teach the scientific method.	167	95	262	69	79	73
5. The value of the material in fulfilling the aims of biology teaching.	168	74	242	73	67	71
6. The inherent value of subject matter itself.	105	74	179	50	67	56
7. The imposed requirements of the government or higher institutions.	127	61	188	55	51	54
8. The bearing of the location of the school.	75	48	123	33	40	36

The histograms in Figure I represent the proportion of the teachers choosing each number of the scale. To illustrate the relations obtaining between the aims of the 24 teachers in Anglo-Saxon type schools and the 14 teachers in Latin type schools, the histograms are drawn proportionally—that is, each group of teachers occupies the same area.

FIGURE 2

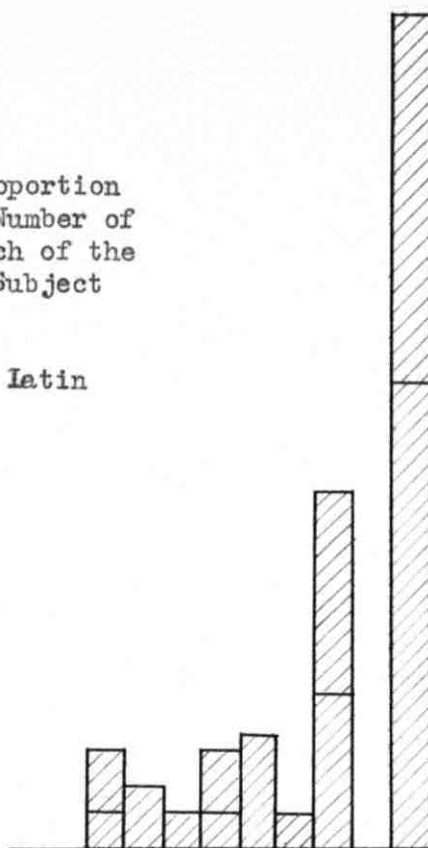
Histograms Representing the Proportion of the Teachers Choosing Each Number of the Scale Which Accompanied Each of the Criteria for the Selection of Subject Matter in Biology

Red - Anglo-Saxon Blue - Latin



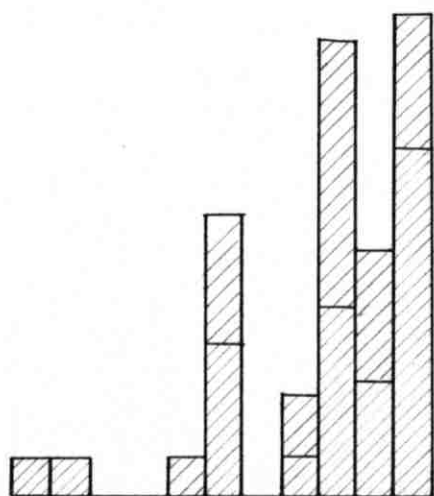
0 1 2 3 4 5 6 7 8 9 10

1. Usefulness in life



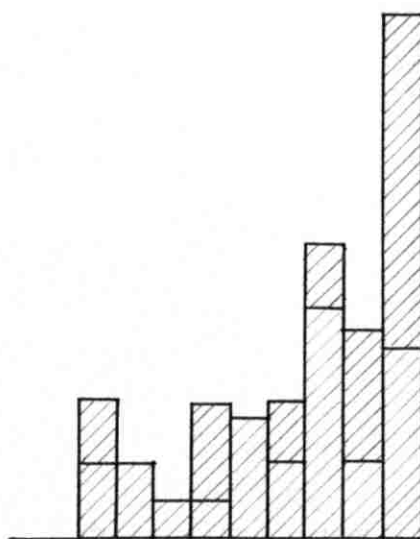
0 1 2 3 4 5 6 7 8 9 10

2. Adaptability to mental maturity



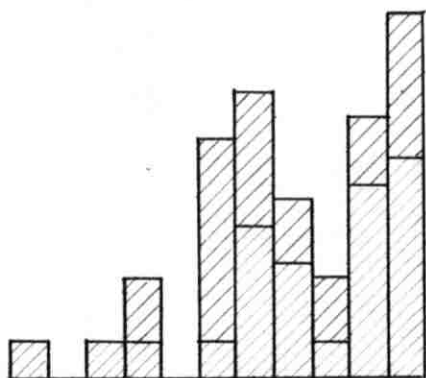
0 1 2 3 4 5 6 7 8 9 10

3. Adaptability to interests



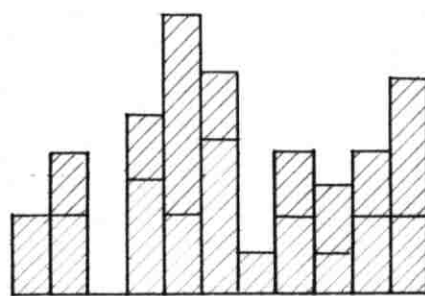
0 1 2 3 4 5 6 7 8 9 10

4. Value to teach scientific methods



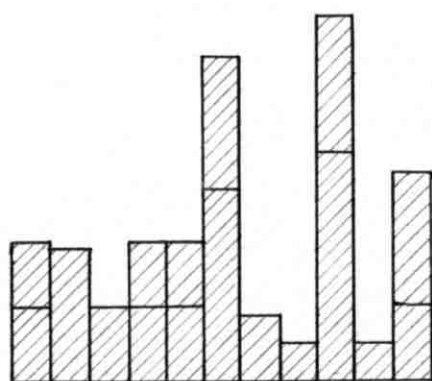
0 1 2 3 4 5 6 7 8 9 10

5. Aims of biology teaching



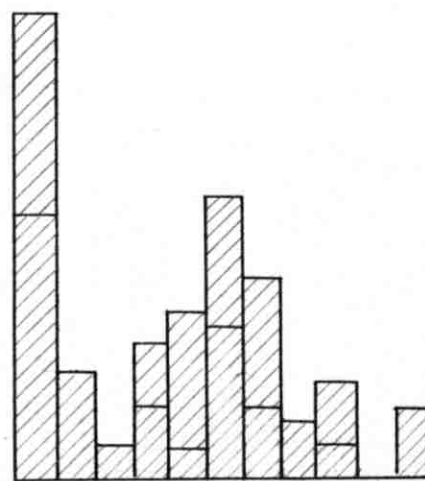
0 1 2 3 4 5 6 7 8 9 10

6. Inherent value



0 1 2 3 4 5 6 7 8 9 10

7. Imposed requirements



0 1 2 3 4 5 6 7 8 9 10

8. Bearing of location

TABLE VII

CRITERIA WHICH WERE CONSIDERED MORE IMPORTANT THAN AVERAGE
BY A SIGNIFICANT PROPORTION OF
TEACHERS

A. Teachers in Anglo-Saxon type schools

1. ** The usefulness of the subject matter in the lives of students.
2. ** The adaptability of the subject matter to the learner's stage of mental maturity.
3. ** The adaptability of the subject matter to the interest of the students.

B. Teachers in Latin type schools

No criterion is considered more important than average by a significant proportion of teachers in Latin type schools, but the three criteria receiving the largest number of "above average" judgment are:

1. The value of the subject matter to teach the scientific method.
2. The adaptability of the subject matter to the learner's mental maturity.
3. The adaptability of the subject matter to the interests of students.

C. Teachers as a whole

1. ** The adaptability of the subject matter to the learner's stage of mental maturity.
2. ** The usefulness of the subject matter in the lives of students.
3. ** The adaptability of the subject matter to the interests of students.
4. * The value of the subject matter to teach the scientific method.

TABLE VIII

CRITERIA RATED LOWER THAN AVERAGE BY A SIGNIFICANT

PROPORTION OF TEACHERS

A. Teachers in Anglo-Saxon type schools:

1. ** The bearing of the location of the school.
2. * The inherent value of subject matter.

B. Teachers in Latin type schools:

1. * The bearing of the location of the school.

C. Teachers as a whole:

1. ** The bearing of the location of the school.
2. * The inherent value of subject matter.

It should be noted that in general there is no significant difference in the evaluation of the criteria by both types of schools. The only criterion which is considered significantly more important by the teachers in Anglo-Saxon schools is "the usefulness of subject matter in the lives of students."

2. The Opinions of Biology Teachers on the Importance of some Units of Subject Matter in Biology.

To obtain the opinions of biology teachers about the importance of some of the units of subject matter of biology, ten different units of subject matter of biology were presented to 38 biology teachers, who were asked to express their opinions about each unit by using one of the phrases:

- a. Very important
- b. Not particularly important
- c. Unimportant
- d. Important but it is not taught.

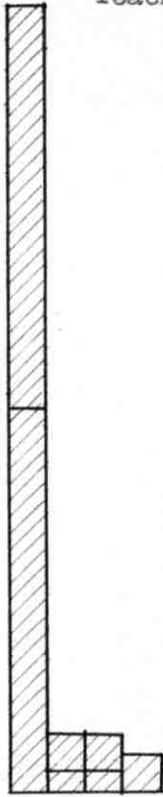
The distribution of the responses of 24 teachers in Anglo-Saxon type schools and 14 teachers in Latin type schools are presented in Figure III.

To illustrate the relation of teachers in both types of schools, the histograms are drawn proportionally—that is, the 14 teachers in Latin type schools occupy the same area as the 24 teachers in Anglo-Saxon type schools.

FIGURE 3

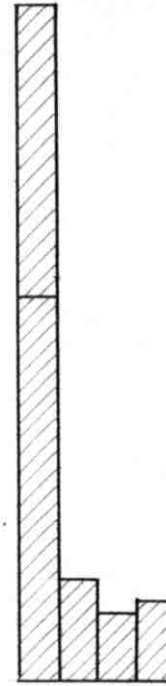
Histograms representing the Proportion of the Responses of Teachers about the Importance of Some Units of Subject Matter in Biology

Red - Angl-Saxon Blue - Latin



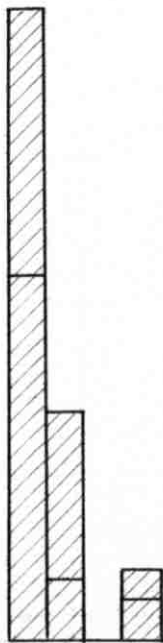
VI. I. U. T.

1. Human physiological functions



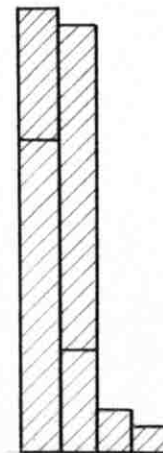
VI. I. U. T.

2. Rules of healthy living



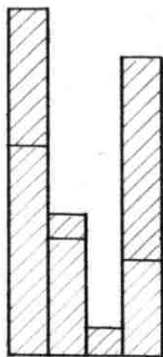
VI. I. U. T.

3. Representative organisms



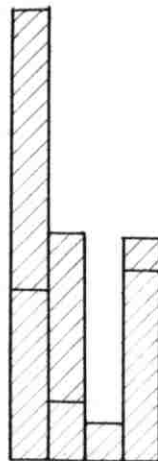
VI. I. U. T.

4. Plant physiological functions



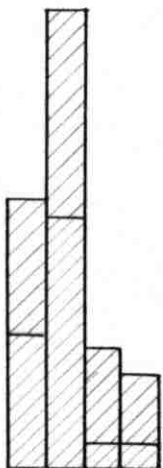
VI. I. U. T.

5. Diseases



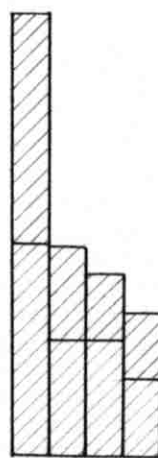
VI. I. U. T.

6. First aids



VI. I. U. T.

8. Taxonomy of organisms



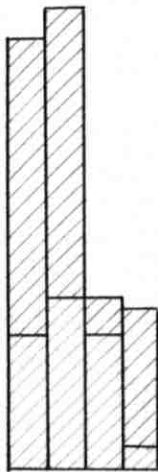
VI. I. U. T.

8. Heredity



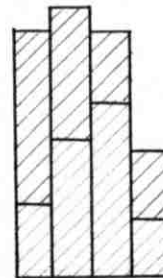
VI.I.U. T.

9. Sex education



VI.I. U. T.

10. Evolution



VI. I. U. T.

11. Agriculture and husbandry

The units of subject matter which were rated important by a significant proportion of teachers, are tabulated below.

TABLE IX

UNITS OF SUBJECT MATTER RATED IMPORTANT BY A SIGNIFICANT
PROPORTION OF TEACHERS IN ANGIO-SAXON
TYPE SCHOOLS

A. Units which are considered significantly important:

1. ** The study of the rules of healthy living.
2. ** The study of the physiological functions of the human being.
3. ** The study of at least one representative organism from each phylum.
4. ** The study of the physiological functions of plants.
5. ** The study of sex education.
6. * The study of diseases.
7. * Taxonomy of organisms. The study of the names of various phyla.
8. * The study of first aid.

TABLE X

UNITS OF SUBJECT MATTER RATED IMPORTANT BY A SIGNIFICANT
PROPORTION OF TEACHERS IN LATIN TYPE SCHOOLS

A. Units which are considered significantly important:

1. ** The study of the physiological functions of the human being.
2. ** The study of evolution.
3. ** The study of the physiological functions of plants.

4. * The study of first aid.
5. * The study of at least one representative organism for each phylum.
6. * The study of the rules of healthy living.

B. Units which are considered significantly unimportant:

1. ** The study of sex education.

TABLE XI

UNITS OF SUBJECT MATTER RATED IMPORTANT BY A SIGNIFICANT PROPORTION OF BIOLOGY TEACHERS OF LEBANON

1. ** The study of the physiological functions of human beings.
2. ** The study of the rules of healthy living.
3. ** The study of at least one organism from each phylum.
4. ** The study of the physiological functions of plants.
5. ** The study of diseases.
6. ** The study of first aids.
7. ** Taxonomy of organisms.
8. * The study of heredity.

Some teachers do not teach some of the selected units of subject matter, but they nevertheless consider them important. From Table XII the outstanding units of this type are:

1. Study of diseases.
2. Study of sex education.
3. Study of first aids.

Table XII presents the numbers and the percentages of 24 teachers in

Anglo-Saxon type schools and 14 teachers in Latin type schools who do not teach a given unit.

TABIE XII

THE NUMBER AND THE PERCENTAGE OF ANGIO-SAXON AND LATIN TYPE SCHOOL TEACHERS WHO DO NOT

TEACH THE FOLLOWING UNITS BUT WHO NEVERTHELESS CONSIDER THEM IMPORTANT

Units of Subject Matter	Anglo-Saxon		Latin		Total	
	No.	%	No.	%	No.	%
1. The study of diseases	5	21.7	6	50	11	32.4
2. The study of first aid.	10	44.4	1	7.1	11	29.0
3. The study of sex education.	6	27.2	4	28.4	10	27.7
4. The study of heredity.	4	16.6	2	14.2	6	15.8
5. The techniques of agriculture and husbandry.	3	13.0	2	15.4	5	13.9
6. The study of evolution.	1	4.2	4	28.4	5	13.2
7. The study of the rules of healthy living.	4	16.6	0	0	4	10.5
8. Taxonomy of the organisms. The study of the names of various phyla and classes of organisms.	1	4.4	2	14.2	3	8.1
9. The study of at least one representative organism from each phylum.	2	8.3	1	7.1	3	7.9
10. The study of the physiological functions of the human being.	2	8.4	0	0	2	5.2
11. The study of the physiological functions of the plants.	1	4.2	0	0	1	2.6

3. Biology Textbooks

One of the main problems of biology teachers is to have a good biology textbook. Some have resorted to the lecture method in order to avoid the use of a textbook; some use more than one textbook, and others use just one. The names of the textbooks which are being used are given in Table. XIII.

TABLE XIII

NAMES OF BIOLOGY TEXTBOOKS USED IN THE SECONDARY SCHOOLS IN
LEBANON

A. Anglo-Saxon type schools

	<u>Author</u>
1. The Energy of Life. Book II	F. Tyrer
2. Biology for First Examinations	H. Cooke, et al
3. Biology in Daily Life.	F. Curtis
4. The Variety of Life. Book II	F. Tyrer
5. An Introduction to Biology	E. Hatfield
6. New Biology	W. Smallwood, et al
7. Biology, the Story of Life	E. Both
8. Elementary General Biology	E. Wyeth
9. Biology, the Science of Life	Macdougall
10. Elements of Biology	W. Smallwood, et al
11. Biology for Junior Forms	M. Lambert
12. Visualised General Biology	A. Burdick, et al

B. In Latin type schools

1. Cours de Sciences Naturelles, (Collection Obre)

Camyort et Gama

2. Science Naturelles	Reunion de professeurs
3. Sciences Naturelles du Brevet Elementaire	Emile Achou

Some schools use more than one book; the following combinations are being used in some schools:

1. Biology for First Examinations and New Biology.
2. Biology for First Examinations and Biology in Daily Life.
3. Biology for First Examinations and the Energy of Life.
4. Biology for First Examinations and General Science and Visualized General Biology.
5. New Biology and Biology for Junior Forms.

Biology teachers were asked to evaluate the biology textbooks they use in terms of the following criteria:

- a. The subject matter content of the textbook.
- b. The organization of the subject matter.
- c. The reliability of the factual content.
- d. The clarity, accuracy and attractiveness of the pictures.
- e. The texture of the textbook.
- f. The price of the textbook.
- g. The comparability of the style to class level.
- h. The exercises, problems and projects of the textbook.
- i. The up-to-dateness of presentation of the biological information.

The teachers were asked to use one of these phrases for each criterion: very poor (P), poor (p), satisfactory (s), good (g), and

excellent (E). Table XIV presents their evaluations. When a textbook was evaluated by more than one teachers, the symbol used by each one is presented. The final column shows the average of the total number of evaluations made for each book.

TABLE XIV

EVALUATIONS OF TEXTBOOKS BY THE TEACHERS WHO USE THEM

	Subject Matter	Organization	Reliability	Pictures	Appearance	Price	Style	Exercises	Recent	Average
1.	The Energy of Life	sss	sss	sss	sss	sss	sss	sss	sss	s to g
2.	Biology for First Examinations	g	s	g	s	s	s	g	g	s to g
3.	Biology in Daily Life	ps	ss	sg	ss	ss	pp	pp	ps	p to s
4.	The Variety of Life	g	g	g	g	g	s	s	g	s to g
5.	An Introduction to Biology	g	g	g	g	g	s	s	g	s to g
6.	New Biology	ss	ss	ps	ss	ss	ss	ss	ss	s
7.	The Story of Life	g	g	g	g	s	g	s	g	g
8.	Elementary General Biology	g	g	s	g	-	g	s	-	s to g
9.	Biology the Science of Life	s	s	p	g	p	p	s	s	p to s
10.	Elements of Biology	g	s	p	g	-	-	g	g	p to s
11.	Biology for Junior Forms	ss	ps	pp	Pp	ps	sg	pp	gg	p to s
12.	Visualized General Biology	g	s	g	g	s	s	s	g	s to g
13.	Cours de Science Naturelles	gg	sg	sg	ss	ss	ps	ss	ss	s to g
14.	Sciences Naturelles	ssg	sss	sss	sss	ssg	sss	sss	sss	s to g
15.	Science Naturelles du Brevet Elementaire	s	s	p	p	s	s	p	s	p to s

Key: Very poor (P), poor (p), satisfactory (s), good (g), excellent (E).

The teachers were also requested to say more about their biology textbooks by giving their advantages and/or limitations and by writing the names of units of subject matter they prepare to supplement the book. Table XV presents their responses. Numbers in parentheses following each statement indicate the number of teachers making that statement.

TABLE XV

FURTHER EVALUATIONS OF THE BIOLOGY TEXTBOOKS

1. The Energy of Life, Book II
 - Needs exercises on lab. work (1)
 - Lacks information about: respiration, function of organs (1)
2. Biology for First Examinations
 - Lacks information about: reptiles, voluox and plant families (1)
3. Biology in Daily Life
 - Suits more to American Life. No consistency in subject matter
 - Lacks information about: genetics, heredity, organ system, life cycles, parasites. Unnecessary parts (1)
4. The Variety of Life. Book I^I
5. An Introduction to Biology
 - Includes practical work (1)
6. New Biology
 - Includes practical work (1)
 - Lacks information about: heredity, circulation, food metabolism and bacteria (1)
7. Biology, the Story of Life
 - Is written for U.S.A.
 - Lacks information on human physiology and heredity, nervous system, echinoderms, bacteria and diseases (1)

8. Elementary General Biology
9. Biology, the Science of Life
Lacks information on: bacteria, sense organs, nervous system (1)
10. Elements of Biology
Lacks information on: local common diseases, natural history and botany (1)
11. Biology for Junior Forms
Orderly presentation, clear pictures and experiments
Lacks information on: protoplasm, photosynthesis, penicillin and heredity (1)
12. Visualized General Biology
Lacks information on heredity and insects (1)
13. Cours de Sciences Naturelles, par Camyort et Gama
Does not meet the requirements of the imposed program
Lacks information on: details of human body, classification and reproduction (1)
Good photography (1)
14. Sciences Naturelles par une Reunion de professeurs
Many details, style is too complex for class level
Subject matter not organized, chemical explanations too complex for class level. Lacks information on: heredity (1)
Vague (1)

4. Grade Level of Biology

To discover the usual grade level of biology instruction in the secondary schools of Lebanon, Freshman students at A.U.B. were asked to indicate the grade level at which they studied biology. Table XVI

represents the responses of students trained in Anglo-Saxon type schools and Latin type schools. In the table first year means the first year of secondary school, following the "Certificat".

TABLE XVI

THE GRADE LEVEL OF BIOLOGY INSTRUCTION IN THE
SECONDARY SCHOOLS OF LEBANON

<u>Anglo-Saxon type schools</u>	<u>No. of schools</u>
<u>Grades</u>	
1. Fifth	6
2. Fourth grade	5
3. Third to Sixth grade	4
4. Fourth and Fifth grades	3
5. Sixth grade	2
6. Second grade	2
7. Third grade	2
8. Fifth and Sixth grades	2
9. Fourth and Sixth grades	1
10. Third to Fifth grade	1
11. Second to Sixth grade	1
12. Third to Fourth grade	1
<u>Latin type schools</u>	
1. Fourth year	1
2. Second to Sixth year	1
3. First to Fourth year	1
4. First and Second years	1
5. Second year	1
6. Fourth to Fifth year	1

SUMMARY

There is considerable agreement among biology teachers in Lebanon about the criteria for the selection of subject matter of biology. They consider the mental maturity, the interests and the needs of the learner to be important criteria for the selection of subject matter, while the location of the school and the inherent value of subject matter as considered relatively unimportant criteria. Teachers in Anglo-Saxon type schools pay relatively more attention to the usefulness of subject matter, while teachers in Latin type schools ascribe relatively more importance to the value of subject matter in teaching the scientific method.

In respect to criteria for selection of subject matter, the standard deviation of the means of the teachers in Latin schools is 1.3, while the standard deviation of the means of the teachers in Anglo-Saxon type schools is 1.7. This means that teachers in Anglo-Saxon type schools tend to assign to various criteria both more consistently positive and more consistently negative judgments, resulting in a wider spread of their means; that is they tend to make stronger differentiations between the various criteria offered.

The opinions of the teachers about some units of subject matter parallels their opinions about the criteria for the selection of subject matter. Teachers in Anglo-Saxon type schools consider human physiology, pathology, hygiene and the study of a representative organism from each phylum very important. Teachers in Latin type schools in general agree with the teachers in Anglo-Saxon schools, the major disagreement being

in sex education. While teachers in Anglo-Saxon schools consider sex education an important unit to be taught, teachers in Latin schools prefer not to teach it. Also, teachers in Anglo-Saxon schools consider the taxonomy of organisms more important than do teachers in Latin type schools, while teachers in Latin schools consider the evolution of organisms more important than do teachers in Anglo-Saxon schools. Also it is a notable fact that almost half of the teachers in Anglo-Saxon type schools do not teach a unit in first aid, although they consider it important that this be taught, and half of the teachers in Latin type schools do not teach about diseases but nevertheless consider it important that this unit be taught.

The biology textbook problem in the secondary schools of Lebanon seems to be an acute one. Various textbooks are being used but there is little satisfaction on the part of teachers. The seriousness of the situation was felt in the interviews with biology teachers and principals. In some cases the principals wanted to know if there was a good biology book to use. Some teachers have ceased using any biology textbook and have resorted to lectures. Others have attempted to complement one of the textbooks by several others. One teacher whose table (a large one) was piled with biology books, was not satisfied with any of them. The desire of many principals and biology teachers is to have a biology textbook especially written for Lebanese youth.

The grade level of biology instruction is uncertain. Different stages have been adopted by various schools. The general tendency is to offer biology in the fourth year in order to teach chemistry and physics in the fifth and sixth years.

CHAPTER V

THE SUBJECT MATTER OF BIOLOGY ACCORDING TO MODERN EDUCATIONAL THOUGHT

By and large, modern experts use the following criteria for the selection of the subject matter of biology.

1. Being the subject matter of biology, it must be determined by the aims of biology teaching.
2. Being part of general knowledge, it must be determined by the theory of knowledge.
3. Being taught to students, it must be determined by the nature of students.
4. Being taught in Lebanon, it must be determined by the imposed requirements of the country.

1. The Aims of Biology Teaching

The first part of the thesis has been entirely devoted to the aims of biology teaching. There is no need to restate them; suffice it to say that before the selection of a unit of subject matter is made, its probable value in attaining the aims of biology teaching must be assessed.

All the biological units of subject matter are not equally valuable in fulfilling the aims of biology teaching; some are relatively useless. Of this kind are the following:

- a. Detailed study of the lower animals: amoeba, paramecium, euglena, hydra, ascaris, starfish, clam, etc.
- b. Detailed study of the lower plants: algae, fungi, liverworts, mosses, ferns, etc.
- c. Detailed study of the taxonomy of organisms: mastigophora, hydrozoa, thallophyta, bryophyta, pteridophyta, etc.
- d. Detailed study of the parts of organisms: kinds of roots, stems, leaves and flowers, kinds of wings, legs, eyes, etc.
- e. The detailed study of the structures of organisms: the longitudinal section of planaria, the cross section of the intestines of the earthworm, the transverse section of xylum, etc.
- f. The detailed study of the names of organs or parts of the organism: the names of the parts of the exoskeleton of the grasshopper, the names of the canals of the sponge, the names of the layers of the lining of intestine, the names of the bones in the human body, etc.

The following units of subject matter are relatively more valuable in fulfilling the aims of biology teaching:

- a. The organization and the functioning of the human body.
- b. The study of diseases: the diagnosis, preventive and curative measures.
- c. The study of the content of nutrients in different foods.
- d. The study of the rules of healthy living.
- e. The study of the habitats of organisms and their relation to man.

However, there are some topics, the functional values of which may not be readily apparent, but which contain inherently valuable learnings. For example, it might be considered a waste of time to do experiments with drosophila, but the value students derive from such experiments in the development of scientific methods and attitudes justifies their inclusion in the biology program.

2. A Theory of Knowledge

The human being in interaction with his environment forms mental impressions about his environment or about a particular element in his environment. The reality of the mental impression determines the degree of the knowledge of the individual about his environment. Some mental impressions are far from being knowledge; they might be called ideas or information because they may not always be true. Something is true if it consistently evokes the same response by all people under the same conditions. Knowledge is tested and verified truth. If a biology student says that he knows how erythrocytes transport oxygen, it means the transportation of oxygen by erythrocytes is a truth and that all persons find it so if they test it.

Knowledge is tested truth but a tested truth may not be knowledge. A person may have the opportunity to learn a tested truth but it may not result in knowledge. He may have memorized it without understanding it. It is tested truth that tubercle bacteria are transmitted by "droplet" infection. A student may reproduce this truth when asked to, but it does not mean that he has understood the meaning of "droplet" infection. Knowledge therefore, is a thorough comprehension of a tested truth rather than the ability to verbalize a tested truth.

A comprehended truth may nevertheless be far from being called knowledge in the sense here intended. Something may be true, and it may be understood by students, but it may not be applicable in the lives of students. That is, it may fall short of solving the daily problems of students; in other words, it may not "work". Therefore, the final test is the workability of a comprehended truth.¹ To the degree that a comprehended truth is "workable" in the lives of students; that is, to the extent that it can be used to satisfy the needs of students; to that degree it may be called knowledge. In the example given, to the degree that an understanding of "droplet" infection works in the lives of students to help them avoid tuberculosis, to that degree it is called knowledge. Workability is the final test to assure the possession of knowledge in an individual.

Therefore any unit to be selected should be tested truth, comprehensible and workable.

1 Brubacher, John S., Modern Philosophies of Education. (New York, 1950), p. 71.

In this sense the memory of long Latin names of various structures and parts of organisms is not knowledge. Words such as: Hypostome, prostomium, tergum, nematocyte, enidoblast, Apopyle, Osculum, typhlosole and supra esophageal ganglia, are neither verifiable, comprehensible nor workable. They are useful only in the degree to which they are related to the comprehension of the functioning of a part of an organism.

3. The Nature of Biology Students

A consideration of the nature of the student is crucial in the selection of subject matter in biology. The discussion of the nature of biology students will be limited to the following points:

- A. The interests of students.
- B. The needs of students.
- C. The mental maturity of students.

A - The Interests of Students

The human being is curious. At any age level individuals are interested in different aspects of life and matter. Biology students are not different; they have their own particular interests which must be satisfied. In the selection of subject matter ignoring or disregarding the interests of students may lead to undesirable consequences. If conflicts arise between the interests of students and the interests of the teacher, the teacher should be wise enough to consider the problem objectively and guide the students. If he finds the interests of students valuable, he should satisfy them; if he finds them unimportant, he should respect them and nevertheless should evaluate them objectively with the students.

Therefore, before the selection of subject matter, tests should be given to students to identify their biological interests.

Such a test was given at the Kansas State Teachers College of Emporia by John Breukelman.¹ He wanted to know what topics were of greatest interest to students and what topics were of least interest. Table XVII presents the most important responses of the students in this study.

TABLE XVII

TOPICS OF GREATEST INTEREST TO ME (508 RESPONDING)

<u>Rank</u>	<u>Topic</u>	<u>Number of students</u>
1	Genetics	379
2	Animals, animal life	112
3	Plants, plant life	104
4	Life processes	97
5	Microorganisms	77
6	Nutrition	66
7	Disease control	48
8	Classification	43
9	Anatomy, dissection	39
10	Evolution	28
11	Insects	26
12	Body systems	9
13	Conservation	9
14	Human biology	9
15	Reproduction	9

1 Breukelman, John. "General Biology at the Kansas State Teachers College of Emporia", Science Education, LIX, 1955, pp. 311-2.

TOPICS OF GREATEST INTEREST TO ME (480 RESPONDING)

<u>Rank</u>	<u>Topic</u>	<u>Number of students</u>
1	Lower plants	164
2	Lower animals	157
3	Microorganisms	135
4	Classification	97
5	Worms	94
6	Insects	90
7	Dissection	63
8	Parasites	51
9	Life processes	30
10	Plants	21
11	Technical names	12
12	Animals	10
13	Conservation	9

It should be noted that the interests of students lie mainly in the life processes of animals and plants, and that in general they are not interested in lower organisms.

Sex Education. One of the controversial issues at present is the offering of sex education in secondary schools. Teachers in Anglo-Saxon type schools claim the importance of it and justify its presence in the biology program. The opinions of teachers in Latin type schools differ significantly. In such cases the interests of the students may profitably be consulted. For the purpose of the present study 506 biology students were asked to express their opinions about sex education by using one of the phrases: "I like it very much, I like it, I do not like it, I hate it, I am indifferent." It was found that students are highly interested in sex education. Table XVIII classifies the frequency and the percentage of the responses.

TABLE XVIII

THE REACTIONS OF 511 STUDENTS FROM GIRLS', BOYS' AND CO-
EDUCATIONAL SCHOOLS TO THE IDEA OF SEX EDUCATION

	Schools for Girls		Schools for Boys		Co-ed. Schools		Total	
	F.	%	F.	%	F.	%	F.	%
I like it very much	33	55	136	59	107	48	276	54
I like it	15	25	58	25	70	32	143	28
I am indifferent	10	16	28	12	33	15	71	14
I don't like it	1	2	4	2	6	3	11	2
I hate it	1	2	5	2	4	2	10	2
Totals	60	100	231	100	220	100	511	100

Naturally students are also interested in other topics. These should be identified and considered in the preparation of the biology program.

B - The Needs of Students

One of the basic criteria for the determination of the subject matter of biology is the needs of students. Subject matter in itself has no value; its value depends upon the satisfaction of needs.

However, it is somewhat difficult to talk about the nature of the needs of students. Students may not be able to identify their real needs, and may want to study those subjects in biology from which they get most pleasure. Such subjects may not be those most closely related to their needs. The role of the teachers is often to make an expert judgment as to what the real needs of students are, and to seek to tie their interests to these.

There are some needs which are common to all students, and all students should have a good knowledge of them. These needs are:

1. How to keep the body healthy.
2. How to select a proper diet.
3. How to prevent and cure common diseases.
4. How to face emergency situations calling for biological knowledge.
5. How to promote public health.
6. How to appreciate the wonders of life.

These needs are immediate and common problems in the daily lives of students. Some needs vary from student to student. The following individual differences create different needs:

1. Sex differences: Girls and boys will not have the same mode of life in the future; therefore they do not have the same needs. No attention has been paid to this fact in the secondary schools of Lebanon. When the principal of one of the girls' schools was asked whether her biology program was in any way different from the biology program in boys' schools, she replied, "Why should I have a different program, since girls sit for the same official examinations?"
2. Future plans. For various reasons many students do not continue their education in higher institutions. Those who intend to continue should be trained to be able to meet the requirements of higher institutions, while those who will not continue should be trained in the essentials of healthy personal and social living.

C - The Mental Maturity of Students

The maturity of students depends largely upon their ages, and the subject matter must therefore be selected according to the age level. Like any other subject, biology also has its simple and difficult parts. Some principles and concepts are difficult to grasp at certain age levels. A teacher should not attempt to explain dihybrid crosses or embryology to junior high school students.

Closely related to the mental maturity of the student is the sequence of the study of the physical sciences, physics and chemistry. The selection of subject matter depends partly upon the knowledge of the students in chemistry and physics. If students are well-trained in these sciences, their understanding in some biological topics will be facilitated. Examples of such topics are: the chemical digestion of the food, the chemical tests for nutrients, the pressure changes during respiration, eye defects, etc.

4. Imposed Requirements

The effect of imposed requirements depends upon their nature, and on the teachers who will follow them. If the imposed requirements are prepared by good educators, they can be of much help to the biology teacher, especially to the beginner; otherwise, they may do more harm than good.

In general, imposed requirements have the following limitations:

- a. They decrease the initiative and the creative ability of teachers and students.
- b. They often fail to meet the needs of students, especially when they have been adopted wholesale from foreign countries.

- c. They tend to change the goal of education from preparation for life to preparation for examinations.
- d. They create a sense of competition among students and schools which may have bad effects as well as good ones.

Along with their limitations, imposed requirements may have the advantage of keeping the teachers alert in their duties.

In the light of modern education, rigid programs, obligatory procedures, and standardized requirements are seldom valuable. However, modern educators consider the fact that one of the basic needs of biology students is preparation for the present and future life. Since the imposed requirements tend to become a need, and thus becomes a legitimate concern of teachers and principals.

Biology Textbooks

In modern educational thought, textbooks are viewed as guides and not as crutches. However, particular attention must be paid to their selection. According to Green, a biology textbook should have the following characteristics:¹

1. It should be arranged and written on some plan, which is clearly defined in an introduction.
2. Indexing and cross reference keys should be prominent.
3. Tabulation of data is an easier form of presentation than paragraph form.

1 Green, T.L., The Teaching and Learning of Biology in Secondary Schools. (London, 1954), p. 60.

4. The text should be not only informative, but should also seek the intelligent cooperation of the student by framing suitable questions.
5. Practical textbooks in zoology require far more complete illustration of operative technique.
6. Tabulated synonyms are of help in terminology.
7. Stereograms are of value in appreciating the relations of three-dimensional structures.

He goes on saying: "Textbooks are too often written from an academic point of view; there is not enough acquaintance with the psychological aspect of the learning process.... We could do well with a cooperative effort in this field, in which the practical teacher, the education-
alist or psychologist, and the technical biologist worked together."

Miller and Blaydes suggest the following criteria for choosing a text.¹

1. Is the subject matter content suitable to the course?
2. Are the organization and presentation of the contents suitable to the level of interest of the class for which the book is being used?
3. Are the factual contents reliable?
4. Are illustrations, graphs, charts, and tables clear, attractive, and appropriate?
5. Does the use of type and arrangement of the material make reading easy?

1 Miller, E.F. and Blaydes, G.W., Methods and Materials for Teaching Biological Sciences, (New York, 1938), pp. 110-5.

6. What is the appearance and the cost of the book?

The tendency in modern educational thought is the use of more than one book. If the school can manage it, the library of the school equipped with good and easily available reference books constitutes the best textbook.

SUMMARY OF CHAPTER V

To select the subject matter of biology for the secondary schools of Lebanon, teachers should take the following criteria into consideration:

1. The subject matter to be selected must meet the aims of biology teaching suggested in the first part of the thesis.
2. The subject matter to be selected must have a use in the life of students.
3. The subject matter to be selected must be tested truth, comprehensible, and workable.
4. The subject matter to be selected must appeal to the student.
5. The subject matter to be selected must meet the legal requirements of the country.

Textbooks should be selected with great care. The modern tendency is to use a number of textbooks to supplement one another.

CHAPTER VI

WHAT SHOULD BE THE SUBJECT MATTER OF BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON

1. Comparison of the Opinions of Modern Specialists in Education and Biology Teachers in Lebanon on Subject Matter in Biology

The opinions and the practices of 38 biology teachers in Lebanon are in some respects in agreement with modern educational thought. The subject matter content on which there is agreement should be maintained in the biology program. The following are the major areas of agreement about the subject matter of biology.

- a. Modern specialists in education and 38 teachers in Lebanon agree that in the selection of subject matter the following criteria should be considered:
 1. The adaptability of subject matter to the learner's stage of mental maturity.
 2. The adaptability of the subject matter to the interests of students.
- b. Modern specialists in education and 24 teachers in Anglo-Saxon type schools agree that in selecting subject matter in biology the usefulness of the subject matter in the lives of students must be considered.

- c. Modern specialists in Education and 14 teachers in Latin type schools agree that in selecting subject matter in biology the value of the subject matter for teaching the scientific method must be considered.
- d. Modern specialists in education and 24 teachers in Anglo-Saxon type schools agree that the inherent value of the subject matter is an important criterion for the selection of subject matter in biology.
- e. Modern specialists in education and 38 teachers in Lebanon consider the following units of subject matter important to be taught:
1. The study of the physiological functions of the human body.
 2. The study of the physiological functions of plants.
 3. The study of the rules of healthy living.
 4. The study of the first aid.
 5. The study of at least one representative organism from each phylum.
- f. Modern specialists in education and 24 teachers in Anglo-Saxon type schools consider the following important units to be taught.
1. The study of sex education.
 2. The study of diseases.
- g. Modern specialists in education and 14 teachers in Latin type schools consider the following an important unit to be taught:
1. The study of evolution.

In the following areas modern specialists in education and teachers in Lebanon are not in accord:

- a. About the following criteria for the selection of subject matter in biology:

1. The bearing of the location of the school is considered more important by modern educational specialists than by 38 teachers in Lebanon.
 2. The value of the subject matter in teaching the scientific method is considered more important by modern specialists in education than by 24 Anglo-Saxon teachers in Lebanon.
 3. The usefulness of the subject matter in the lives of students is considered more important by modern specialists in education than by 14 teachers in Latin type schools.
 4. The inherent value of subject matter is considered less important by modern specialists in education than by 14 teachers in Latin type schools.
- b. About units of subject matter.
1. Evolution is considered more important by modern specialists in education than by 24 teachers in Anglo-Saxon type schools.
 2. Sex education is considered more important by modern specialists in education than by 14 teachers in Latin type schools.
 3. The study of diseases is considered more important by modern specialists in education than by 14 teachers in Latin type schools.
- c. Modern specialists in education do not agree with most of the schools in Lebanon on the grade level at which biology is being taught.
- d. Judging by the criteria they have set up, experts do not approve fully of the biology textbooks which are being used in the secondary schools of Lebanon.

- e. Modern specialists in education do not approve fully the biology programs implied by the various imposed requirements. The major points of disagreement about the 1) Lebanese Baccalaureat program, 2) General Certificate Examinations, and 3) A.U.B. are the following:

2. Evaluation of Subject Matter of Biology in Baccalaureat Program.¹

- a. In the Baccalaureat Program the program of concrete sciences is classified under Physics, Chemistry, and Natural Sciences. The Natural Sciences includes biology, astronomy, and geology. The use of the term "Natural Sciences" to include only biology, astronomy and geology cannot be justified because the sciences of chemistry and physics also are natural sciences. It would be better if the term "Biological Sciences" were used and astronomy and geology were classified as separate sciences.
- b. In the Baccalaureat Program the sequence and articulation with other sciences does not seem to be adequate. The sciences of chemistry and physics are necessary to understand some parts of biology, therefore if one of the three sciences should come out at the end of the program, it should be biology. Just the reverse has been adopted in the Baccalaureat Program. In the first four years students study biology without chemistry and physics, and they study only chemistry and physics in the fifth and sixth years.

Students who do not continue their education after Baccalaureat I need more of biology in their subsequent lives than they do if chemistry

1 Appendix C, 3

and physics. In this respect teaching only chemistry and physics in the fifth and sixth years is not justifiable.

Students who graduate from the Mathematics section of Baccalaureat II have a very weak background in biology. Those who study engineering will be left with only their fourth year elementary biology.

c. The Baccalaureat program as it is stated, produces more confusion than certainty. It is not shown clearly to what extent the various required topics should be discussed. One finds items such as:

1. "Study of nervous system.
2. "Classification of plants.
3. "Notions about human physiology and anatomy."

Such items might be discussed in five minutes or in five days.

d. The Baccalaureat program of the first year starts with a detailed study of man. A detailed study of the human body needs a general knowledge of chemistry and physics. According to the elementary school program, students of the first year do not have the necessary background to understand the composition of bones, the physiology of muscles, the chemical constituents of diets, etc. The phrase "detailed study" found in the Lebanese Baccalaureat Program should be changed to "introductory notions", in order to be clear, consistent and feasible.

e. All through the Baccalaureat Program of the secondary cycle in Lebanon no attempt has been given to synthesize the sciences of physics, chemistry and biology, to form a general science. This is particularly necessary for the first three or four secondary classes. For example, in the first year the science program deals with the following major

topics. Gravity, heat, light magnetism, preparation and properties of several gases, NaCl , CaCO_3 and properties of matter. Man (several physical systems), animals, vegetables and geology. Besides being crowded, there is no continuity and no relationship and interdependence of topics. It is a kind of tasting small bites of different kinds of foods and leaving the meal while one is still hungry. It would be better if several related topics were taught under the name of General Science. Preparation of such a program is beyond the scope of the thesis, but to clarify the idea the following example is given:

In the 1st grade respiration might be one of the units. Under respiration the following integrated topics might be studied:

1. The parts of the respiratory system.
2. The functions of the parts of the respiratory system.
3. The composition of air we inhale.
4. The properties of the gases we inhale.
5. The composition of the gases we exhale.
6. The significance of plants in this change of composition of gases.
7. The control of the diaphragm, nerves.
8. The pressure changes in the chest and lungs. Boyle's Law.
9. The production and the measurement of heat in the process of respiration.
10. Diseases of the lung.

In this way students study physics, chemistry and biology as one integrated science.

f. In the Baccalaureat Program a great deal of attention has been given to subject matter content. The needs of students are not properly considered. There are topics which are of no use for the majority of students, and there are others which are neglected in spite of the fact that they are very useful.

Some unnecessary parts are the detailed consideration of:

1. Reptiles, batrachians, articulates, mollusces, zoophytes.
2. Classification of plants.
3. Classification of vegetables.
4. The thallophites, mushrooms, algae, lichens, mosses, vascular cryptogams, phonocrogams.
5. Gymnosperms.
6. Antiosperms.
7. Dicotylidons.
8. Lower invertebrates.

On the other hand some topics are neglected which are the essence of biology, such as:

1. Evolution.
2. Sex education.
3. First aid in emergency cases.
4. Genetics and heredity.
5. Embryology.
6. Study of diseases.
7. Contributions of biologists.
8. Hygienic rules for keeping the body healthy.

3. Evaluation of Subject Matter in Biology in General Certificate Examinations Program.¹

a. General Certificate Examinations requirements have marked differences from the Lebanese Baccalaureat Program, such as:

1. The General Certificate Examination does not classify the syllabus into special grade levels. It is left to the biology teacher to set the sequence of biology with other sciences. The flexibility of the program is an advantage in fitting with the particular needs of various schools.
2. The fact that the General Certificate Examination allows a student to sit for biology or botany at advanced or ordinary levels, provides an opportunity for advanced or specialized studies according to the interests of the students.
3. Though both the General Certificate Examinations and the Baccalaureat Program include human physiology, yet the latter evidences a much greater emphasis on this topic.
4. The General Certificate Examination is specially prepared for England. The program is based partly upon the plants and the animals of England. Sometimes it is very hard to find in Lebanon the exact animal or plant required.

b. In general, a close study of the program reveals the fact that the General Certificate Examination also is not based upon the "functional concept" of biology teaching. Topics and details are included which are not needed by the students, such as:

1 Appendix C, 2

1. Types of nutrition in mucor.
2. Morphology throughout the year of a herbaceous plant.
3. The structure of seeds.
4. Outlines of the external structure of insects (cockroach, butterfly, bee, mosquito and house fly).
5. Life histories and habits of at least five animals and five plants (other than the insects mentioned).
6. The appearance without anatomical detail, and natural history of a fern, a moss, a green algae, yeast, mucor, a parasitic fungus, etc.

The following important units are not included:

1. Heredity; Mendelian ratios, elementary genetics, human eugenics, etc.
2. Sex education.
3. Study of common diseases.
4. Detailed study of the human life functions.

The General Certificate Examination tends to be more academic than the Lebanese Baccalaureat Program. It may be well adapted to the high schools in England, but it is not suitable in Lebanon.

4. Evaluation of Subject Matter of Biology in A.U.B. Biology Program.¹

The American University of Beirut has been one of the greatest factors in the determination of the curricula of the secondary schools in Lebanon. This has been specially true for Anglo-Saxon type schools.

¹ Appendix C, 1

With respect to the requirements of A.U.B. high schools fall into several categories:

- a. Those which have been approved by the University. Their graduates are admitted to the University without entrance examinations.
- b. Those which have been partially approved; their graduates take only special entrance examinations.
- c. Those which have not been approved; their graduates take full entrance examinations to enter the University.

Schools in the first category organize their biology programs themselves. There is no restriction whatsoever, apart of course from the indirect control of the A.U.B. aptitude tests given at the end of the school year.

Schools in the second category usually are of the same nature as those in the first category because the special examinations which their graduates take in most cases are in the English language.

Schools in the third category are required to choose two of the following examinations in sciences: physics, chemistry, biology and general science. Therefore if a school does not teach biology at all it is possible for its graduates to get a perfect score. Schools which do not teach biology often advise their students to sit for general science and either chemistry or physics. Such students may obtain perfect scores, because the general science questions by themselves permit the election of items which are purely physics or chemistry.

Students who sit for biology entrance examinations face easy

questions¹ which can be answered by the general knowledge of most students. In the entrance examinations of the past ten years, the biology entrance examinations have been the easiest and weakest. No pains have been taken to prepare a comprehensive examination. Probably one of the reasons for this is the uncertain requirements of A.U.B. The entire A.U.B. biology requirement is given by the sentence, "Based on a year's work in zoology, botany or general biology including experiments with animals or plants themselves."²

1 Appendix D, 1

2 The American University of Beirut. Information for 1956-57, pp. 17-18.

5. Recommendation of Biology Program for the Secondary Schools of Lebanon.

What is true in respect to the aims of biology is equally true for the selection of the subject matter of biology. That is, the reader should bear in mind that the recommended subject matter is in no way fixed. Some of the recommendations will ultimately require changes. Since the secondary schools of Lebanon are not identical in all respects, but vary in their locations, philosophies and social structures, the recommended subject matter cannot be expected to apply equally well to all of them.

The following considerations form the background for the proposed program:

The central axis of the recommended biology program is the life functions of the human body. It is divided into five major units in the following way:

First year, introduction to life functions in the human body. A preliminary discussion of the functions to prepare the students for the other units. Prior chemistry or physics is not required.

Second year. The hygiene of life functions. This is included early so that students will practice the hygienic rules they learn during their school years. It does not presuppose chemistry and physics.

Third year. Life functions in various organisms. This is to show life functions in different forms of organisms. It does not require a knowledge of chemistry and physics. One of the aims is to give students a familiarity with the variety of living things.

Fourth year. Life functions in the human body. This is to meet the Brevet requirement. The chemistry and physics which the students will have studied during the preceding three years is needed for the comprehension of this unit.

Fifth year. Devoted entirely to physics and chemistry so that they may be used in the advanced topics of biology in the sixth year.

Sixth year. Advanced biology. Discussion of advanced topics. The first part of the program is for boys and the second part for girls.

RECOMMENDED PROGRAMFirst YearUNIT I - INTRODUCTION TO LIFE FUNCTIONS

1. Introduction to biology.
 - A. Meaning of the term biology.
 - B. Characteristics of organisms (life functions).
 - C. Definition of each life function.
2. Digestive System.
 - A. Identification of the organs of digestive system in a mammal.
 - B. Functions of the organs of digestive system.
 - C. Different kinds of food.
3. Respiratory System.
 - A. Identification of the organs of respiratory system in a mammal.
 - B. Functions of the organs of respiratory system.
 - C. The composition of the inhaled and exhaled air.
4. Circulatory System.
 - A. Identification of the parts of circulatory system in a mammal.
 - B. Functions of the parts of respiratory system.
 - C. The composition of blood.
5. Skeletal System.
 - A. Identification of the parts of skeletal system in a mammal.
 - B. Functions of bones.
 - C. Composition of bones.

6. Muscular System.

- A. Identification of the muscles of a mammal.
- B. Functions of muscles.
- C. Different types of muscles.

7. Nervous System.

- A. Identification of the parts of nervous system in a mammal.
- B. Functions of the parts of nervous system.
- C. Elementary study of the sense organs.

8. Excretory System.

- A. Identification of the organs of excretory system in a mammal.
- B. Functions of the organs of excretory system.
- C. Composition of urine.

9. Interdependence of Life Functions.

- A. Relation of digestive system to circulatory system.
- B. Relation of digestive system to excretory system.
- C. Relation of digestive system to respiratory system.
- D. Relation of muscular system to skeletal system.
- E. Relation of nervous system to other systems of the body.

Second YearUNIT II - THE HYGIENE OF LIFE FUNCTIONS1. Digestive System.

- A. How to select a balanced diet.
- B. How to keep the teeth healthy.
- C. What to do in case of tooth-ache.

2. Respiratory System.

- A. How to perform artificial respiration.
- B. What to do when foreign bodies enter the nose and throat.
- C. What to do in the case of fainting and suffocation.

3. Circulatory System.

- A. How to keep the heart and the blood vessels healthy.
- B. How to stop nosebleed.
- C. What to do in the case of arterial and venous bleeding.
- D. What to do in the case of accidental poisoning.
- E. What to do in case of snake and scorpion bites.

4. Skeletal System.

- A. What is good posture?
- B. What is good walking?
- C. What is good sitting?
- D. What to do in case of sprains and fractures.

5. Muscular System.

- A. What is the role of exercise in healthy living?
- B. How much sleep is needed?
- C. What to do in case of cuts and burns.
- D. What to do in case of sunstroke.

6. Nervous System.

- A. How to keep the senses healthy.
- B. What to do in case of foreign bodies in the senses.
- C. What are the effects of drinking alcohol?

7. Excretory System.

- A. How to keep the skin clean.
- B. What type of clothing is needed?
- C. How to ventilate rooms.
- D. How to avoid contagious diseases.

Third YearUNIT III - LIFE FUNCTIONS IN VARIOUS ORGANISMS1. Digestive System.

The digestive organs, the functions of the digestive organs, the nature of food and the mode of nutrition in:

- | | |
|--|-------------|
| A. The frog. | C. Amoeba. |
| B. The house fly. | D. Ascaris. |
| E. The flowering plant. Photosynthesis, the transmission of the food through different structures, oxidation of the food in the cells. | |

2. Respiratory System.

The organs, their functions and characteristics in:

- | | |
|---|-----------------------|
| A. The frog. | C. The grasshopper. |
| B. The fish. | D. The invertebrates. |
| E. Flowering plants. Leaf structure, types, stomata, transpiration. | |

3. Circulatory System.

The organs, their functions and the characteristics in:

- | | |
|---|-----------------------|
| A. The frog. | C. The earthworm. |
| B. The bird. | D. The invertebrates. |
| E. Flowering plants. Study of mono and dicot stems, venation. | |

4. Excretory System.

- | | |
|----------------------|---------------------|
| A. The frog. | C. The fish. |
| B. The bird. | D. The grasshopper. |
| E. Flowering plants. | |

5. Nervous System.

The organs, their functions and the characteristics in:

- A. The frog.
- B. The bird.
- E. Plants. Parts of a flower, pollinations, development of the ovule.
- F. Bacteria.
- C. Hydra.
- D. Ameoba.

7. Skeletal System.

The parts, their functions and the characteristics in:

- A. The frog.
- B. The clam.
- C. The bird.
- G. The plants. The study of roots. The study of supporting tissues in the stems.
- D. The starfish.
- E. The grasshopper.
- F. The sponge.

Fourth YearUNIT IV - LIFE FUNCTIONS IN THE HUMAN BODY1. Digestive System.

- A. Identification of the organs of digestive system.
- B. Study the digestive process; salivary, gastric, intestinal digestions and absorption.
- C. Study of the common diseases of digestive system. Diagnosis care and prevention; appendicitis, ulcers, desentary, typhoid fever.

2. Respiratory System.

- A. Identification of the organs of respiratory system.
- B. The study of the mechanism of breathing.
- C. Composition of the inspired and expired air.
- D. The mechanism of the exchange of gases in the lung.
- E. Study of the common diseases of the respiratory system.
Common cold, pneumonia.

3. Circulatory System.

- A. Identification of the parts of the circulatory system.
- B. The study of the mechanism of blood flow.
- C. The study of the composition of the blood.
- D. Venous and arterial blood pressure.
- E. The study of the limphatatic system; structures, functions, and compositions.
- F. The study of common diseases of circulatory system; anemia, malaria, hemorrhage.

4. Excretory System.

- A. Identification of the organs of excretory system.
- B. The mechanism of discharging waste materials from: kidney, skin,

lung and large intestine.

C. Composition of the discharged materials.

D. The study of the common diseases of the excretory system.

5. Nervous System.

A. The identification of the parts of the nervous system.

B. Functions of the different parts of the nervous system: autonomic, sympathetic and parasympathetic nervous systems.

C. The study of the sense organs; structures, and functions; vision, hearing, taste and smell.

D. The study of the common diseases of the nervous system.

6. Glandular System.

A. Identification of the glands of the human body.

B. The functions of the endocrine glands; thyroid, parathyroid, pituitary, adrenal.

C. The study of the common diseases of the glandular system.

7. Reproductive System.

Part I - for boys

A. Anatomy and the physiology of the male reproductive organs.

B. Maturation of the sperm cells.

C. Seminal emissions.

D. Masturbation and its effects.

E. Sex education. Advice on continent living.

F. The study of common diseases of the male reproductive system.

Part II - for girls

A. Anatomy and the physiology of the female reproductive system.

B. Maturation of the ovum.

- C. Menstruation and its effects on the body.
- D. Sex education. Advice on continent living.
- E. Study of the common diseases of the female reproductive system.

Sixth YearUNIT V - ADVANCED BIOLOGY FOR BOYS1. Heredity.

- A. Mitosis and meosis.
- B. Dominant and recessive characters.
- C. Mendelian ratios.
- D. Sex-linked characters.
- E. Human genetics.
- F. Elementary eugenics.
- H. Hybrids. Their economic value.

2. Embryology.

- A. Maturation of the gametes.
- B. Stages of development.
- C. Prenatal nourishment of the embryo.

3. Evolution

- A. Historical development of the theory.
- B. Evidences to support the theory.
 - a. Evidences from paleontology.
 - b. Evidences from embryology.
 - c. Evidences from mutation and genetics.
 - d. Other evidences.

4. Ecology

- A. Meaning of habitat. Habitat factors; climatic, physiographic and biotic factors.
- B. The relation of animals to plants.

- C. The relation of the type of soil to the distribution of the animals in Lebanon.
 - D. Distribution of the plants in Lebanon.
5. Agriculture and Husbandry.
- A. Kinds of soils and their relation to plant growth.
 - B. Elementary techniques to raise animals and plants.
 - C. Elementary principles of farming.
 - D. Diseases of plants.
 - E. Conservation of plants and animals.
6. Modern Developments in the Field of Biology.
- A. X-Ray. Its application in medicine.
 - B. Electrocardiogram.
 - C. Radio-active elements, their application to plants and animals.

Sixth YearUNIT V - ADVANCED BIOLOGY FOR GIRLS1. Heredity and Embryology.

- A. Mitosis and meosis.
- B. Dominant and recessive characters.
- C. Mendelian ratios.
- D. Sex-linked characters.
- E. Human genetics.
- F. Elementary eugenics.
- G. Maturation of gametes.
- H. Stages of development of the embryo.
- I. Prenatal nourishment of the embryo.

2. Dietetics.

- A. The calorific values and the vitamin contents of common foods, vegetables and fruits.
- B. Skills in preparing balanced diets.
- C. Methods of cooking.
- D. Preparation of food for special cases, such as:
 - a. Infancy.
 - b. Childhood.
 - c. Common diseases.

3. Elementary Nursing.

- A. How to take the temperature of the human body.
- B. How to take the blood pressure of the human body.

- C. How to disinfect materials.
- D. How to give injections.
- E. How to prepare the patient's room.
- F. How to care for a patient.
- G. How to care for a baby.

Principles of Biology

All through the biology syllabus, biology teachers should see that the students assimilate the principles of biology. The following are some of the biological principles:¹

1. The cell is the unit of structure and function in all organisms.
2. Cells are organized into tissues, tissues into organs, and organs into systems to carry on the functions of complex organisms.
3. Energy and matter are not created or destroyed in the reactions associated with the life processes but are passed on from organism to organism in endless succession.
4. The energy which makes possible the activity of most living things comes at first from the sun and is secured by the organism through the oxidation of food within its body.
5. The fundamental life processes are the same in all organisms.
6. From the lower to the higher forms of life, there is an increasing complexity of structure, and this is accompanied by a progressive increase in division of labor.
7. The less the amount of parental care given to the offspring, the greater is the need for an animal to be prolific.
8. The existing forms of life on the earth are only a small part of all the forms of life which have existed; there have been many animals and plants which have become extinct.
9. The organisms most likely to survive and reproduce are those that are structurally and physiologically best fitted to their environments.

1 For the complete list see: Green, T.L., Teaching and Learning Biology in Secondary Schools (London, 1954), p. 29.

10. Life may exist under conditions of light from bright sunlight to the complete darkness of caves or of depths of soil or water, and there are few regions on the earth where some form of life does not exist.
11. The balance in nature is maintained through interrelations of plants and animals with each other and with their physical environment.
12. Plants and animals are directly or indirectly dependent on the soil.
13. All communicable diseases are caused by microorganism and for each disease caused by such an organism a specific microbe exists.
14. All life comes from previously existing life and reproduces its own kind.
15. Living things tend to resemble their parents in major respects and to differ from them in minor respects.
16. Acquired characters are not inherited.
17. As a rule, the more highly specialized an organism is, the more likely it is to become extinct if its environment changes.
18. Reproduction is a fundamental biological process that provides for the continuance of life on the earth by providing new individuals.
19. There is a constant building up and tearing down within the body of every living organism - the principle of cellular organization.
20. The varying success of organisms in adapting themselves to various environmental conditions has given rise to geographical and climatic groupings - the principle of distribution.

21. Scientists generally believe that all forms of life on earth today have developed through the ages by gradual changes influenced by both heredity and environment, as the progeny of some simple primordial organisms--the principle of evolution.
22. The interdependence and interrelations of living things give rise to a natural equilibrium, the temporary disturbance of which takes the form of epidemics - the principle of balance in nature.

6. Recommended Biology Textbooks

Data in Chapter IV revealed the need of a good biology textbook for the secondary schools of Lebanon. This is not a local need; T.L. Green, speaking about biology textbooks, says, "The personal opinion of the writer, opinions collected from others and the data presented elsewhere in this book, makes it clear that one of the problems of biology teaching today is that of the textbook... The problem of providing textbooks of a suitable kind is acute. Many are available but too few are suitable."¹ Probably in the existing situation in Lebanon, a good solution lies in the use of references. It would perhaps be best if biology teachers worked hard in the first year, circulating mimeographed sheets prepared from the reference books.

A recommended book list of references is:

<u>Name</u>	<u>Author</u>
1. A Junior Course in Hygiene	J.H. Crawford
2. A Senior Course in Hygiene	J.J. Stooke
3. Hygiene and Health Education	M.B. Davies
4. Human Physiology	T. Tokay
5. Biology, A Textbook for First Examination	H.J. Cooke
6. Discovering Biology (Book I, II, III & IV)	F. Tyrer
7. Visualized General Biology	A.J. Burdick
8. Biology in Daily Life	F. Curtis
9. Elementary Biology for Examinations and Allied Examinations	M. Phillips, et al
10. Dynamic Biology Today	Baker & Mills

1 Ibid. p. 61.

11. Principles of General Biology	Gardiner
12. Biology and Man	Greenberg and Bingham
13. Problems in Biology	Hunter
14. Modern Biology	Moon, et al
15. Foundations of Biology	Woodruff & Baitseel
16. How the Body Works	L.S. Michaelis
17. Furneaux's Human Physiology	W.A. Smart (Ed.)
18. Hygiene, Infectious Diseases & Dietetics	D.H. Geffen, et al
19. Methods and Materials for Teaching Biological Sciences	D. Miller & G. Blaydes

If one textbook is to be used for each year of the recommended program, probably the first four textbooks of the reference list used successively are the most suitable ones. For the sixth year program, textbooks on the college level should be consulted in preparing lectures.

A SUMMARY OF PART II

Chapter IV presented data which describe the existing status of subject matter of biology in the secondary schools in Lebanon according to 38 teachers. There is some degree of agreement on the criteria for subject matter selection among the biology teachers as a whole. However, biology teachers in Anglo-Saxon type schools give more importance to the usefulness of the subject matter in the daily lives of students than teachers in Latin type schools; while the latter give more importance to the value of subject matter to teach scientific methods. Teachers in Anglo-Saxon type schools consider the teaching of sex education and diseases more important than teachers in Latin type schools; while the latter consider the teaching of evolution more important. There is a common dissatisfaction with the textbooks used, and the need for a textbook specially written for Lebanon is acute.

Chapter V presented modern educational thought in respect to the subject matter of biology. It discussed four points to be considered for the selection of subject matter: the aims of biology teaching, a theory of knowledge, the nature of students and the imposed requirements.

Chapter VI attempted to bring together compatible ideas from Chapters IV and V so as to be able to recommend a desirable biology program for the secondary schools of Lebanon. A biology program is recommended which is based on the functional concept of modern educational thought, its central axis being the life functions.

PART III

HOW SHOULD BIOLOGY BE TAUGHT IN THE SECONDARY SCHOOLS

OF LEBANON

CHAPTER VII

THE EXISTING STATUS OF THE METHODS OF BIOLOGY TEACHING IN THE SECONDARY SCHOOLS OF LEBANON

The existing status of the methods of biology teaching in the secondary schools of Lebanon was investigated with respect to the following:

1. The general types of teaching methods in use as reported by 38 biology teachers in the secondary schools of Lebanon.
2. The nature of the actual classroom procedures used by 38 biology teachers during the biology periods in the secondary schools of Lebanon.
3. The nature of the biology laboratory and the laboratory equipment in 38 secondary schools of Lebanon.

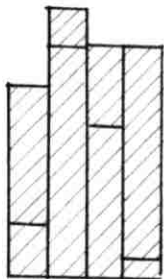
1. The Methods Used to Teach Biology in the Secondary Schools of Lebanon.

To determine the nature of the methods followed by biology teachers, five different general methods were presented to 38 biology teachers and they were asked to indicate how often they practised each method by using one of the phrases: Exclusively, often, seldom, and never. The distribution of the responses of teachers is presented in Figure 4.

FIGURE 4

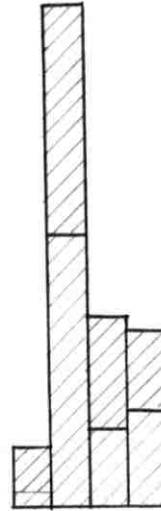
Histograms Representing the Proportion of 24 Teachers in Anglo-Saxon Type Schools and 14 Teachers in Latin Type Schools Practising Each Method

Red - Anglo-Saxon Blue - Latin



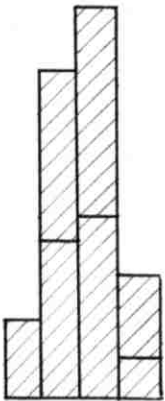
E O S N

1. Lecture



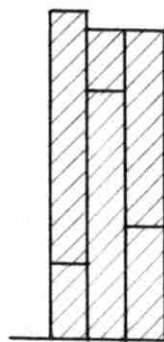
E O S N

2. Recitation



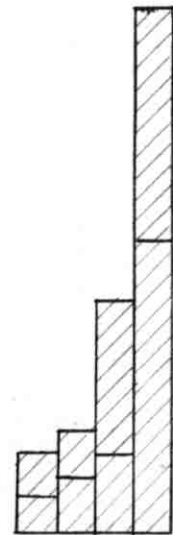
E O S N

3. Demonstration



E O S N

4. Laboratory



E O S N

5. Socialized methods

It is evident from the histograms in Figure 4 that biology teachers in Anglo-Saxon type schools most often practise the lecture and the textbook-recitation methods, while biology teachers in Latin type schools most often practise the textbook recitation and the laboratory methods. The laboratory method is seldom or never practised by the majority of the teachers in Anglo-Saxon type schools; similarly socialized methods are practised by almost none of the biology teachers in the secondary schools of Lebanon.

No significant difference was found between the proportions of Anglo-Saxon type teachers and Latin type teachers responding in any one category.

2. The Nature of the Teaching Procedures.

The nature of the teaching procedure was investigated with regard to:

- A. The activities of the biology teachers during the biology lesson.
- B. The behavior of the biology students during the biology lesson.
- C. Other activities associated with the methods of biology teaching.
- D. The nature of the biology laboratory in the Secondary schools of Lebanon.

To investigate the nature of the teaching procedures, about thirty four biology classes were attended at various places of Lebanon. The classroom atmosphere was observed as objectively as possible according to the observation check list.¹

The classroom procedures observed were of the following types:

¹ See Appendix A, 4

In four schools the teacher discussed the lesson. The students participated with their questions and answers.

In three schools the students took oral examinations. The teacher stood or sat almost still, in front of the students. In his left hand he held an open copy book and in his right hand either a pen or a pencil. At the beginning of the class all the students had their textbooks open on their desks; they were reading their assignments without raising their eyes. Recitation began and the teacher called on one of the students. The student left his seat and went to the front of the class near the teacher. The teacher then asked two or three questions. The student attempted to answer them. He was judged, graded, and returned to his place. Another student was called, several questions were asked, he too was graded and sent back to his place. In one school, after twenty minutes of this, ten students had been examined, fourteen students had their eyes still fixed on their books, while the other ten students had closed their books and were talking. Some cursed the lesson and the question, others gloated over their good luck in having been asked easy questions.

In two schools students conducted the lesson. Several students had prepared reports on special topics; they read the reports in turn and then the teacher evaluated them.

In two schools the teacher picked students once at a time to read the assignment from the textbook. While a student was reading, some of the rest followed him, but others were careless.

In one of the schools students watched a biological film. On my second visit to the same class, the teacher conducted the lesson,

discussing the daily assignment with the students.

In one of the schools the students were not in their classroom. It was the laboratory period. They were sitting very close to one another. Some were observing leaves and tracing them; others were examining sections of leaves with microscopes.

In nine schools teachers lectured all through the period. During the lecture students were very anxious to write down the exact words of the teacher. After fifteen minutes of dictation, the students became tired, and wanted to rest, but they could not; they had to continue till the ringing of the bell, at which time they gave a deep sigh of relief.

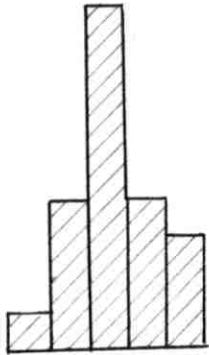
A. The activities of the biology teacher during the biology lesson was observed according to the following scheme:

- a. How the teacher started the lesson.
- b. How he distributed questions.
- c. How he ended the lesson.
- d. How he had planned the lesson .

Each of these points was assessed by checking one of the following: Very good, good, satisfactory, poor and very poor. Figure 5 presents the evaluation of the teaching process in the above-mentioned terms.

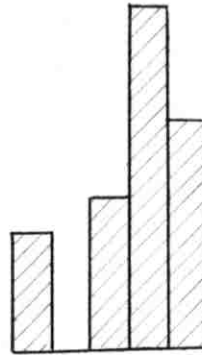
FIGURE 5

Histograms Representing the Quality of the Teaching
Procedures in the Biology Classes of 21 Secondary
Schools in Lebanon



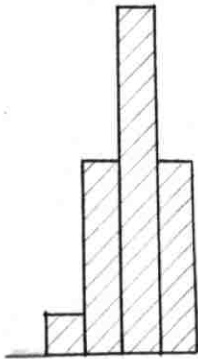
VG. G. S. P. VP.

1. Starting the lesson



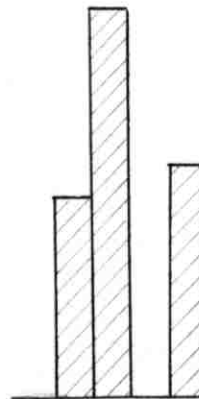
VG. G. S. P. VP.

2. Distribution of questions



VG. G. S. P. VP.

3. Ending the lesson



VG. G. S. P. VP.

4. Planning the lesson

B. The behavior of biology students during the biology lesson.

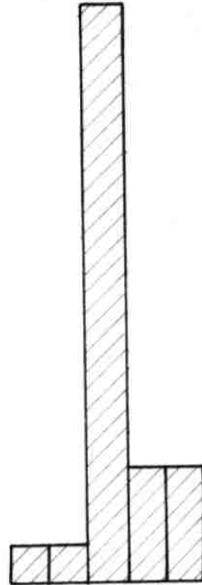
Students were observed with respect to:

- a. The preparation of their lessons.
- b. Their interest in the lesson.
- c. Their participation.

Each of these points was evaluated by checking one of the following: Very good, good, satisfactory, poor, very poor. Figure 6 presents the evaluation of the behaviour of students during the biology period.

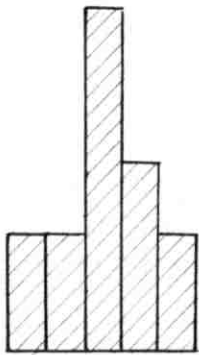
FIGURE 6

Histograms Representing the Behavior of Biology Students in the Biology Classes of 21 Secondary Schools in Lebanon



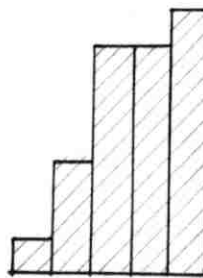
VG. G. S. P. VP.

1. Interest



VG. G. S. P. VP.

2. Preparation



VG. G. S. P. VP.

3. Participation

C. Other activities associated with methods of biology teaching.

In this respect eight direct questions were put to biology teachers in the secondary schools of Lebanon. The questions and the responses of 38 biology teachers are classified in Table XIX.

It should be noted that, without exception, the percentage of schools which never carry on a described activity is the highest percentage reported for that activity.

TABLE XIX

THE RESPONSES OF 24 TEACHERS IN ANGLO-SAXON TYPE SCHOOLS AND 14 TEACHERS IN LATIN TYPE SCHOOLS ABOUT SOME CLASSROOM ACTIVITIES, SECOND LINES REFER TO TEACHERS

IN LATIN TYPE SCHOOLS

		<u>Percentage of Teachers Reporting</u>				
		<u>Never</u>	<u>Once</u>	<u>Twice or Thrice</u>	<u>4 or 5</u>	<u>more than 5</u>
1.	How many times has the class gone on a field trip?	A-S L 54.2 29.2	12.5 14.2	25.1 21.4	4.1 0	4.1 14.2
2.	How many times has the class seen films or filmstrips?	A-S L 37.6 57.2	16.6 0	25.1 21.4	16.6 21.4	4.1 0
3.	How many projects has each student carried alone or in groups?	A-S L 62.6 64.4	4.1 7.1	20.8 14.3	0 7.1	12.5 7.1
4.	How many charts, diagrams, models etc. has each student prepared?	A-S L 37.6 71.5	8.3 0	16.6 4.1	8.3 0	29.2 21.4
5.	How many reports has each student written	A-S L 58.3 64.4	8.3 0	25.1 14.2	0 0	8.3 21.4
6.	How many times have you invited other persons to give a lecture or to perform a demonstration?	A-S L 80.0 71.6	8.3 0	8.3 21.3	4.1 7.1	8.3 0
7.	How many times has the class gone to a medical school?	A-S L 87.6 71.6	4.1 7.1	8.3 14.2	0 7.1	0 0
		<u>No</u>	<u>Yes</u>			
8.	Is there a science club in your school?	A-S L 79.2 85.7	20.8 14.3			

D. The nature of the biology laboratory in the secondary schools of Lebanon.

The nature of the biology laboratory was investigated along the following lines:

- a. The number of schools which had a biology laboratory.
- b. The length of the biology laboratory period.
- c. The biology laboratory equipment.
- d. The animals dissected in the biology laboratory.
- a. The number of schools which had a biology laboratory.

At each school visited the request was made to see the biology laboratory. 60% of the schools reported that they did not have a biology laboratory. 20% of the schools used the chemistry laboratory for biology experiments. 10% of the schools used their classrooms as a laboratory and the remaining 10% had a special laboratory for biology. Latin type schools which have the "Philosophie" class, possess well-equipped biology laboratories; but those with only "Baccalaureat Ie. classe" have no biology laboratories.

To get further information about biology laboratories in the secondary schools not visited in Lebanon, 44 Freshman and Sophomore Lebanese students were asked about the laboratory condition in the secondary schools they attended. Their responses are classified in Table XX.

TABLE XX

RESPONSES GIVEN IN PERCENTAGE OF 44 A.U.B. FRESHMAN AND SOPHOMORE STUDENTS CONCERNING THE LABORATORY OF SECONDARY SCHOOLS ATTENDED

	%
1. It had a laboratory for other sciences, but not for biology	28.1
2. It had a regular laboratory period every week for other sciences, but not for biology.	20.2
3. It had no laboratory periods, but the teacher demonstrated experiments in biology.	13.6
4. It had a laboratory used for biology and other sciences	13.5
5. It had a regular laboratory period every week for biology	9.1
6. It had a special laboratory exclusively for biology	6.7
7. It had neither a laboratory nor demonstrations in biology	6.7
8. It had no laboratory for other sciences	2.2

b. The length of the biology laboratory period.

The biology teachers were asked how much time they gave for individual or group laboratory work in biology per week. Their responses are classified in Table XXI.

TABLE XXITHE LENGTH OF BIOLOGY LABORATORY PERIODS PER WEEK IN 24ANGLO-SAXON TYPE SCHOOLS AND 14 LATIN TYPE SCHOOLS

(Numbers are given in percentages)

	0 min.	30 m.	40 m.	60 m.	90 m.	120 m.	more than 120
Anglo-Saxon	54.2	12.5	8.3	12.5	8.3	4.2	0
Latin	71.6	7.1	7.1	7.1	0	0	7.1

c. Biology laboratory equipment.

A list of biology laboratory apparatus was presented to biology teachers and they were asked to write down how many of each item of the list they had in their laboratory. Also, they were asked to add to the list other apparatus they had but which was not included in the list. Table XXII shows the responses of the teachers.

It should be noted that the percentage reporting "none" for each category is invariably the highest percentage for that category.

TABLE XXII

THE RESPONSES OF 24 TEACHERS IN ANGLO-SAXON TYPE SCHOOLS AND 14
TEACHERS IN LATIN TYPE SCHOOLS ABOUT THEIR BIOLOGY LABORATORY

EQUIPMENT

(The numbers are given in percentages. The lower numbers refer to teachers in Latin type schools)

<u>Apparatus</u>	<u>none</u>	<u>one</u>	<u>two or three</u>	<u>4-5</u>	<u>more than 5</u>
1. Compound micros.	45.7 57.2	12.6 7.1	25.0 28.6	4.2 0	12.5 7.1
2. Dissecting "	91.6 85.8	4.2 7.1	4.2 0	0 7.1	0 0
3. Insect killing jars	70.6 78.7	4.2 7.1	20.8 7.1	0 0	4.2 7.1
4. Stethoscope	100 64.4	0 21.4	0 0	0 14.2	0 0
5. Microprojector	87.5 78.6	8.3 14.3	4.2 0	0 0	0 7.1
6. Opaque project.	95.8 78.6	4.2 21.4	0 0	0 0	0 0
7. Film strip proj.	70.8 50.0	20.8 28.6	4.2 21.4	0 0	4.2 0
8. Motion picture projector	66.6 78.6	33.4 0	0 0	0 0	0 21.4
9. Aquarium	87.5 85.8	8.3 7.1	4.2 7.1	0 0	0 0
10. Models	83.4 71.5	8.3 7.1	0 0	0 0	8.3 21.4
11. Insect collecting bag	87.5 92.9	0 0	8.3 0	4.2 0	0 7.1
	<u>0</u>	<u>1-10</u>	<u>11-30</u>	<u>31-50</u>	<u>more than 50</u>
12. Dissecting sets	58.3 50.0	29.2 50.0	12.5 0	0 0	0 0
13. Zoology slides	54.1 71.5	4.2 0	12.5 21.4	12.5 0	16.7 7.1
14. Botany slides	50 71.5	8.3 7.1	29.3 14.3	8.3 0	4.1 7.1

<u>Apparatus</u>	<u>0</u>	<u>1-10</u>	<u>11-30</u>	<u>31-50</u>	<u>More than 50</u>
15. Flower pots	83.5 85.8	4.1 0	4.1 7.1	0 0	8.3 7.1
16. Dissecting pans	70.8 71.5	20.9 28.5	8.3 0	0 0	0 0
17. Wall charts	58.4 64.4	16.6 28.5	25.0 7.1	0 0	0 0

Other apparatus was added to the list by some schools. Petri dishes, hand-lens, bone-cutter, terrarium, incubator, brush.

Content of dissecting sets: scissors, probes, scalpel, forceps, dropper, ruler.

d. The animals dissected in the biology laboratory.

A list of animals was presented to biology teachers and they were asked to write "yes" in front of an animal in the list if they dissected at least one thereof in one academic year. They were also requested to add to the list other animals they dissected.

The responses of the biology teachers are given in Table XXIII.

TABLE XXIII

THE RESPONSES OF 24 ANGLO-SAXON TEACHERS AND 14 LATIN TEACHERS ABOUT
THE DISSECTION OF SOME ANIMALS. THE NUMBERS ARE GIVEN IN PERCENT.

<u>Animals</u>	<u>A-S</u> <u>Yes</u>	<u>L</u> <u>Yes</u>	<u>A-S</u> <u>No</u>	<u>L</u> <u>No</u>
1. Sponges	37.5	21.4	62.5	78.6
2. Hydra	41.6	21.4	58.4	78.6
3. Ascaris	25.1	74.9	74.9	25.1
4. Earthworm	41.6	58.4	58.4	41.6
5. Clam	16.6	21.4	83.4	78.6
6. Starfish	41.6	14.2	58.4	85.8
7. Cray fish	41.6	14.2	58.4	85.8
8. Grasshopper	37.5	41.6	62.5	58.4
9. Frog	54.2	35.7	45.8	64.3
10. Bird	16.6	7.1	83.4	92.9
11. Cat	4.2	7.1	95.8	92.9
12. Dog	0	21.4	100.0	78.6
13. Rabbit	25.1	28.5	74.9	71.5
14. Mouse	4.2	14.2	95.8	85.8

The following animals were added to the list:

Anglo-Saxon type schools

1. Fish
2. Snail
3. Bee
4. Butterfly
5. Caterpillar
6. Turtle
7. Squid

Latin type schools

1. The egg of hen
2. Tissues
3. Embryos
4. Guinea pig
5. Heart of sheep
6. Eye of cow
7. Brain of sheep

SUMMARY OF CHAPTER VII

The most common teaching methods used in the secondary schools of Lebanon were recitation and lecture; and the least-used methods were socialized methods and laboratory. Teachers in Anglo-Saxon type schools used the lecture more often than teachers in Latin type schools; the latter (if they happened to have the "Philo" class) used the laboratory method more than teachers in Anglo-Saxon type schools.

On the whole the teaching procedures in the biology classes tended to be poor. The beginning of the lesson and the planning of lessons might be considered relatively satisfactory, but the distribution of questions and the concluding of the lessons were unsatisfactory. The attitudes of students in the biology class varied from school to school. In general students seemed to be interested, but their preparation of the lesson and their participation were rather unsatisfactory. It is possible that the presence of an outsider may have had an undesired effect.

With respect to other classroom activities associated with the methods of biology teaching, most of the biology teachers do not take their classes to a medical school; do not invite other persons to give a lecture or to perform an experiment; do not give projects to students; do not take their classes on a field trip, do not assign reports to students and do not have a science club.

Teachers in Anglo-Saxon type schools practise the following activities significantly more often than teachers in Latin type of schools:

showing of films or filmstrips, drawing charts and diagrams. Teachers in Latin type schools take their biology classes on field trips significantly more often than teachers in Anglo-Saxon type schools do. Nineteen schools in every ten in Lebanon, do not have a special laboratory for biology, therefore most of the schools do not have laboratory experiments. Most of the secondary schools do not have the following apparatus: compound microscopes, dissecting microscopes, a microprojector, an opaque projector, a filmstrip and motion picture projector, aquaria, models, insect collecting bags and killing jars, dissecting sets, slides, flower pots, dissecting pans and wall charts. No significant differences was found between the two types of schools as regards the availability of biology laboratory equipment.

Most of the secondary schools of Lebanon do not examine the following animals in laboratory: clam, starfish, ascaris, crayfish, bird, cat, dog, rabbit and mouse. The most commonly used animals for observation are: protozoans, earthworm, ascaris and frog.

CHAPTER VIII

THE METHODS OF BIOLOGY TEACHING IN MODERN EDUCATIONAL THOUGHT

Modern educational specialists consider the following criteria in selecting methods of biology teaching:

1. Since biology teaching aims at attaining certain goals, the methods should be selected according to the aims of biology teaching.
2. Since biology teaching involves biological subject matter, the methods should be selected according to the nature of the biological subject matter.
3. Since biology teaching implies a learning process, the methods should be selected according to the nature of the learning process.
4. Since biology teaching involves a learner, the methods of biology teaching should be determined by the nature of the learner.

1. The Aims of Biology Teaching.

One of the primary criteria for the selection of methods of biology teaching is the goal of biology teaching. Once the goal is set, it becomes quite easy to find the proper method to attain it. If the aim of a biology teacher is to prepare his students for official examinations, all through the year he tends to cram into the minds of students, factual subject matter which might appear in the examination. He will not be anxious to have a laboratory and to waste time on long experiments. He will not be willing to assign projects and other biological activities. He will not be interested in the psychology of his students. He will not be willing to consider what the biological needs of the students will be after they take the official examinations. He will think only in terms of A.U.B., General Certificate Examination, or Lebanese Brevet examination questions. He resorts to the lecture method. He lectures all through the year trying to make the factual biological knowledge of students perfect so that at the time of the appearance of the questions the chances of hitting them by memorized answers will be great.

On the contrary, if the aim of a biology teacher is to prepare his students for life, so that they will be able to meet the needs of life, he takes a different attitude. He finds out the interests, the needs and the individual differences of his students. He considers the nature of the learning process and the factors which favor it. He understands the limitations of the lecture and appreciates the importance of other methods to fulfill the aims of biology teaching.

The first part of the thesis was entirely devoted to the aims of biology teaching. Modern educators believe that there is no single method which can attain all the aims, nor is there a particular aim which can only be attained by one method. Modern educators try to apply the most appropriate methods to achieve a particular aim.

2. The Nature of Biological Subject Matter.

Biological subject matter, due to the accumulation of new knowledge all through the ages, has been highly varied qualitatively and quantitatively.

The following are a few of the different kinds of subject matter met in biology classes:

- a. Abstract knowledge of laws, theories, hypotheses and principles.
- b. Taxonomy of organisms: kingdoms, phyla, classes, orders, families and species.
- c. Diversity of organisms: vertebrates and invertebrates, multicellular and unicellular, macroscopic and microscopic, live animals and dead specimens.

Modern educators do not put such a variety of subject matter under a single method. Each kind of subject matter has its special teaching method which must be searched out and applied.

3. The Learning Process.

To give a complete picture of the learning process is outside the scope of the thesis, suffice it to mention briefly some of the

findings of educational psychology which might be of help in selecting the proper methods of biology teaching.

Experiments on the learning process have not resulted in a unanimous agreement among educators. There are several schools of thought which differ in their points of views on the learning process; but they tend to agree on the following psychological factors which influence learning.

A. The Psychological Factor in Learning.¹

"You can drive a horse to a brook, but you cannot make him drink" is a well known statement. Ideal aims of biology teaching might be selected and the best subject matter might be prepared, but if the students do not cooperate with teachers all efforts may be fruitless. To inspire and to motivate the students is a necessity in the teaching process. Motivation is a psychological awakening of the students to proceed willingly to a desirable end.

Since motivation conditions the learning process, it is pertinent to present some factors which motivate students.

The following techniques are found to be good motivating agents:

a. Making the subject matter meaningful to students.

Intrinsic motivation is one of the most genuine types of motivation techniques. Once the student understand the significance, the usefulness and the meaning of the activity he is going to undertake, he develops enough effort and concentration to carry on that activity successfully. Imposed activities

1 Ryan, J.J., et al, An Outline of Educational Psychology, (New York, 1951), pp. 62-64.

with uncertain goals and procedures keep the students passive and lead the activities into predictable failure.

b. Praise and blame. The effect of these depend on other factors such as the confidence of the students and the nature of the activity. Usually praise has good effects. Both praise and blame have stronger effects under the following conditions:

1. When practised by favoured teachers.
2. When practised occasionally.
3. When practised for deficient activities.
4. When practised on single students.
5. When practised on inferior students.
6. When practised at the beginning of the year.

As far as possible, blame and insult should not be practised. In rare cases it may have a value, but in general it is more of a destructive measure rather than an instructive one.

c. Rivalry. An increase of 47% in the achievement of school children with the introduction of rivalry has been obtained. The work of the superior upper fourth of the group has been increased 34%, that of the lowest fourth 71%.¹ However, the outcome of rivalry may be desirable or undesirable depending upon the control of the teacher. An uncontrolled rivalry between students or groups of students may result in jealousy. The best rivalry is when a student competes with his past.

1 Ibid. p. 63

- d. Rewards and punishments. Again these depend upon the factors which influence praise and blame. Relatively these are not good motivating agents. Punishment may result in antagonism, and rewards may turn in time into pseudo-goals of learning. As far as possible punishment should not be practised, and rewards should be given rarely, preferably at the end of the year.
- e. Knowledge of progress. It is generally held that when students know their progress they are motivated. Successful results, especially at the beginning of the year, may endow some students with a great zeal till the end of the year. If students do not know the nature of their past achievements they cannot have self confidence in their new activities. The awareness of success by students will make them even more successful. "Nothing succeeds like "success" can have practical results in the lives of students.

B. Guiding Principles for Effective Learning.

Lator offers the following seven guiding principles about the psychology of the learning process in relation to biology.¹

The Principles of Learning

- a. Learning is most efficient when interest becomes inherent in the material to be learned.
- b. A problem to be solved will focus attention on the elements in the situation which appear to be relevant to the solution of the problem.

1 Green, T.L., The Teaching and Learning of Biology in Secondary Schools, (London, 1954), p. 44.

- c. Consciousness of unanswered questions brings a state of dissatisfaction which is removed by finding the answers to the questions.
- d. Do not form bonds (associations) which must be broken.
- e. Attach responses to the situations in which they are to be used.
- f. Ensure these situations and responses which are to be connected, are identified, in the mind of the learner.
- g. Repetition strengthens bonds.

C. Factors for Effective Learning Situations.

Similarly W. M. Davis offers the following factors for the effectiveness of a learning situation in secondary science.¹

- a. Other factors being equal, effective learning is more likely to occur when the teacher has a broad background of knowledge in the particular science he is teaching as well as in the related scientific areas.
- b. Other factors being equal, effective learning is more likely to occur when the teacher has a functional knowledge of how children develop and how learning takes place.
- c. Other factors being equal, effective learning is more likely to occur if the teacher knows about, understands, and uses a variety of methods of instruction as opposed to the exclusive use of one or two methods.
- d. Other factors being equal, effective learning is more likely to occur when the teacher is living the life of a normal citizen in the community, exerting community leadership appropriate to his educational position.

1 Davis, W.M., "Factors of Effectiveness in Science Teaching..." Science Education, LVIII (1954) p. 151-2.

- e. Other factors being equal, effective learning is more likely to occur in our society when the teacher has well-thought-out and consistent philosophy of teaching and when the teaching practised is consistent with the stated philosophy.
- f. Other factors being equal, learning will proceed more effectively when the teacher is skilled in the use of classroom aids and devices, when he is familiar with, has accumulated, and uses teaching materials of various kinds, and when he knows about and uses sources of information beyond the single textbook.
- g. Other factors being equal, learning will proceed more effectively when the teacher has established rapport with the learners and when the learners believe that the teacher is well-informed and effective.
- h. Other factors being equal, learning will proceed more effectively when the major professional interest of the teacher and his major expenditures of time and energy are connected with teaching and not with some other occupation.
- i. Other factors being equal, learning will proceed more effectively when there is rapport and mutual respect between the science teacher and his immediate supervisor.
- j. Other factors being equal, learning will be more effective if the teacher is not carrying an excessive load, either by reason of an excessive number of preparations, an excessive number of pupils per day, or an excessive extra-curricular or out-of-school series of responsibilities.

- k. Other factors being equal, learning will be more effective in a school which has a wide variety of science offerings than in one which has a very limited number of such offerings.
- l. Other factors being equal, more effective learning is likely to occur when the program of the school is directed toward providing for the special needs of the youth of the community rather than when the program is not so directed.
- m. Other factors being equal, more effective learning is likely to occur when the program of the school is directed toward providing for the general educational needs of youth than when the program is not so directed.
- n. Other factors being equal, learning will proceed more effectively when the learners and the teacher sense the direction of the teaching, when both participate in the planning and when the learners see the fulfilment of their own aims implicitly in the objectives of the course.
- o. Other factors being equal, learning will proceed more effectively if the amount and type of laboratory equipment needed to fulfill the aims of the work is present and in operating condition, and if the number and type of aids, devices, supplies, and materials are at hand and in condition to be used.
- p. Other factors being equal, learning will proceed more effectively in a good physical environment than in a poor one.
- q. Other factors being equal, learning will be likely to be more effective when considerable attention is given to problem solving, development of critical thinking and scientific attitudes.

It is appropriate here to mention an additional principle which applies particularly to science education. This is the principle of the priority of learning by experience over learning through abstract reasoning. Inferences and generalizations are based on observations and experiments.

4. Psychology of Students.

Since the teaching of biology involves students, the nature of students should be considered for the selection of the proper methods of biology teaching. The discussion of the psychology of students is presented along the following lines:

- A. The characteristics of adolescents.
- B. The interests of students.
- C. Individual differences.

A. The Characteristics of Adolescents.

The teacher should know the characteristics of his students in order to deal with them satisfactorily. Reymond pictures the characteristics of adolescents as follows:¹

- a. The body becomes capable of strenuous exertions.
- b. Relations between the sexes acquire a vastly enhanced significance.
- c. Sense of storm and stress.
- d. A period of daydreaming.
- e. A period of adventure.
- f. A state of unsatiated curiosity.
- g. A state of intense intellectual vivacity.
- h. In short, "Renaissance age of the individual".

1 Reymond, T.A., Modern Education: its Aims and Methods.

Heiss, Obourn and Hoffman characterise the students at junior and senior level as follows:¹

Characteristics of junior high school pupils.

- a."They are going through a period of rapid growth.
- b."Their interests are centered in sports, teamwork, collecting, animals, adventure, romance and mystery.
- c."They have a strong desire to excel.
- d."They like to explore and make discoveries for themselves.
- e."They seek group approval and often go to extremes of behavior to secure it.
- f."They have a strong desire and a keen interest to understand themselves.
- g."There is a desire for freedom balanced by the sense of a need for security and belonging.
- h."Their play is self-directed to a large degree and is, generally, well-organized.
- i."There is the beginning of a wide interest in the group and in community concerns.
- j."There is a desired aim to achieve their full capacities.
- k."There is an accelerated development in motor skill and ability.
- l."There is a wider interest in reading.
- m."There is an awakening to, and interest in, ideals.
- n."There is a beginning interest in the vocational pursuits of adults.

¹ Heiss, E.D. et al, Modern Science Teachers, (New York, 1950) pp. 68-70.

Young people on the senior high school level.

- a. "Tend to grow in independence and to resent domination of authority, especially of adults.
- b. "Tend to grow in idealism and in the development of desirable attitudes such as tolerance and open-mindedness.
- c. "Are in a period of rapid growth and therefore may be awkward and clumsy in physical manipulation.
- d. "Evidence the varying maturity of the sexes more sharply than at the lower levels.
- e. "Seek earnestly to understand themselves in relation to others especially those of the opposite sex.
- f. "Are groping for answers in the field of values such as the meaning of success, the nature of life, etc.
- g. "Are experiencing a period of intense specialized interests.
- h. "Are growing in the skills needed for abstract thinking and problem solving.
- i. "Want to deal with their problems on a mature level but seek guidance from their elders.
- j. "Are intensely interested in materials for which they can see immediate application .
- k. "Are exceedingly realistic and desire to have materials treated "in the raw" rather than glamorized."

B. Interests of Students

The natural activities of schools children are the outcome of their interests, and in general the nature of the activity depends to a large extent on the interest of the student creating that activity. That is, the stronger the interest of a student the more efficient is the activity, for interest begets attention, and attention begets effort.

All efforts at finding a disinterested pupil will fail except in the case of abnormal children. Since interest and effort are inter-related, to achieve good results methods of teaching must be selected in terms of the interests of the students.

Difficulties in the presence of conflicting interests between a student and a group, or between a group and the teacher are expected. In such cases it is often useful to be tolerant, to sacrifice the teacher's interest, if necessary, and find a common interest, however naive it may be; then the teacher should start guiding the student's interests to the desirable goal. This seems very difficult in practice, yet there is no better alternative; teaching must start from the natural interests of students.

In Chapter V, an attempt was made to find the interests of students in respect to the subject matter of biology in order to help to determine the biology program. A similar attempt was made to find interests of students in some of the aspects of the methods of biology teaching. Fifteen statements about different aspects of methods of biology teaching were presented to about 500 biology students. They were asked to comment on each statement, as to whether they "like it very much," "like it," "do not like it," hate it."

Table XXIV represents in decreasing order the interests of biology students in the above mentioned biological methods.

TABLE XXIVTHE INTERESTS OF ABOUT 500 BIOLOGY STUDENTS IN SOME BIOLOGICAL
METHODS AND ACTIVITIES

1. ** To have sex education.
2. ** To have high grades.
3. ** To watch a film about the different aspects of biology.
4. ** To do experiments with animals and plants.
5. ** To ask questions in the biology class.
6. ** To study the biology lesson.
7. ** To watch a demonstration in the classroom.
8. ** To go on a field trip to collect insects, plants, etc.
9. ** To have announced quizzes, often at least once in a week.
10. ** To draw the different parts of organisms.
11. ** To take lecture notes.
12. * To prepare models of heart, kidney, liver, etc.

Similar questions about some aspects of biological methods were put to about 100 Lebanese Freshman and Sophomore students at A.U.B.

Table XXV represents in decreasing order the interests of students in the above mentioned aspects of biological method.

TABLE XXVTHE INTERESTS OF ABOUT 100 A.U.B. LEBANESE FRESHMAN AND SOPHOMORE
STUDENTS IN SOME BIOLOGICAL METHODS AND ACTIVITIES

Note: Items 1 through 7 were accepted in a significant proportion of cases. Items 8 through 10 were rejected in a significant proportion of cases.

1. ** To go on a field trip for educational purposes.
2. ** To watch a film or a filmstrip.
3. ** To watch a demonstration.
4. ** To do laboratory experiments.
5. ** To have a science club.
6. ** To have the lessons in the form of discussions.
7. ** To do laboratory experiments individually not in groups.
8. ** To have unexpected drop quizzes.
9. ** To follow the textbook strictly.
10. ** To have the lesson in the form reading from the text in class.

C. Individual Differences

It is only in a factory where the same machines produce thousands of articles, all exactly the same in size, texture and form. The classroom is not a factory and teaching is not mass production. No two students can be exactly the same in all respects. The existence of differences between two students is as true as the fact that two things cannot occupy the same place at the same time. Variation is a universal law.

There is variation among biology students in the following respects:

- a. Intelligence; some may be brighter than others.
- b. Physical make-up; some students may be physically healthier than others.
- c. Age. Some students may be older than others, especially in schools where biology is taught in more than one class.

- d. Sex. A class may consist of boys, of girls, or of both boys and girls.
- e. Social relations. Students may come from widely differing societies or communities.
- f. Temperament. Some students may be naturally more sensitive than others.
- g. Talent. Some students may have special talents, such as music, drawing, etc.
- h. Memory. Some students may have a better memory than others.
- i. Aims. Some students may take biology with altogether different aims than others.

The above mentioned differences were investigated for this study.

The responses of girls and boys about some aspects of teaching methods were compared to discover if any significant sex differences exist.

Contingency tables were drawn for the responses of students from girls' schools and boys' schools and Chi-square values computed.

Table XXVI represents some aspects of biology teaching methods in which a significant proportion of boys are more interested than girls.

TABLE XXVISOME ASPECTS OF BIOLOGY TEACHING METHODS IN WHICH A SIGNIFICANT
PROPORTION OF BOYS ARE MORE INTERESTED THAN GIRLS

1. * To do experiments with animals and plants.
- 2.*To watch a demonstration in the classroom.
3. * To draw different parts of animals and plants.
4. * To go on a field trip to collect insects, plants, etc.

Education should consider the development of the individual; therefore the method to be used to develop an individual will depend upon the nature of that individual. In one sense, to develop the potentialities of a pupil the ideal class is a class containing one student. Such a system is unworkable, not to mention its other shortcomings. What it implies is that in a class of more than one pupil, as far as possible the methods of teaching should be as varied as the students. Different types of methods must be used with different students at different times.

SUMMARY OF CHAPTER VIII

Criteria considered for the selection of methods for biology teaching:

1. The aims of biology teaching. The methods selected should fulfill the aims of biology teaching. Since the nature of the aims of biology teaching varies, different methods should be applied, each specific to the aim it pursues.

2. The nature of subject matter of biology. The methods selected should be applicable to the subject matter of biology. Since the subject matter of biology consists of different kinds of biological topics, therefore different methods should be applied, each specific to the topic it is used for.

3. Nature of the learning process. A list of principles which makes the learning process more effective was presented. The methods selected should be practised according to the principles of the learning process to make their results more fruitful.

4. Psychology of students. In selecting the methods of biology teaching, the characteristics, the interests and the differences of students should be considered.

CHAPTER IX

WHAT SHOULD BE THE METHODS OF BIOLOGY TEACHING IN THE SECOND- ARY SCHOOLS OF LEBANON?

1. Comparison of the Opinions of Modern Specialists in Education and Biology Teachers in Lebanon on the Methods of Biology Teaching.

Modern experts in education do not agree with the existing status of the methods of biology teaching in the secondary schools of Lebanon. Some of the major differences of opinion are:

- A. Modern experts in education consider the lecture and recitation method less important than they are considered by the sample of biology teachers in this study.
- B. Modern experts in education consider demonstrations, laboratory work and socialized methods more important than they are considered by the sample of biology teachers.
- C. Modern experts in education consider the following activities more important than they are considered by the sample of biology teachers:
 - a. Taking the students on a field trip.
 - b. Taking the students to medical schools.
 - c. Showing films and filmstrips.
 - d. Giving projects to students.
 - e. Preparing charts, diagram and models.
 - f. Performing laboratory experiments and demonstrations.

- g. Inviting resource persons to the class.
 - h. Having science clubs.
- D. Modern experts in education give more importance than the sample of biology teachers to the following criteria for the selection of the methods of biology teaching:
- a. The conditions which make learning more effective.
 - b. The characteristics of biology students.
 - c. The interests of biology students.
 - d. The individual differences among biology students.

2. Recommended Methods of Biology Teaching in the Secondary Schools of Lebanon

Biology teaching does not have a single method. Because of the diversity of the aims it pursues, the diversity of the subject matter it treats, and the diversity of students it involves, it tries to use all the methods, and each in its right place and time. In the following pages, the advantages, the limitations and the principles for the effective use of each method will be described. It is the task of each biology teacher to exercise his ingenuity in applying them where and when he finds them most effective.

A. The Lecture.

a. Advantages of the lecture method.

1. The lecture method is relatively easy. The teacher may simply dictate his notes to students.
2. The lecture method is the cheapest method. It may not need any apparatus or other materials to expose the lesson.
3. The lecture method presents the lesson in an organized and systematic way. The lack of a good textbook is not a serious problem.

4. The lecture method trains the students to be good listeners.
5. If the lecture method is carefully practised, it is one of the ways of teaching appreciation.
6. The lecture method covers more subject matter than most of the other methods.

b. Disadvantages of the lecture method.

1. The lecture method is not well-suited to the nature of students. Biology students are active; they want to do something. The lecture leaves the students in a passive state, contrary to their nature. The fact that students write during the lecture can be considered only as a very minimum activity. A frequent characteristic of a passive state is monotony. Activity is characterized by change, creativity and, too often, entirely lacking in the lecture-note-taking relationships.
2. The lecture method does not consider individual differences. Some students may be slow in writing, and others may not be interested in the topic.
3. The lecture method tends to give undue importance to subject matter. Problem-solving abilities, and the development of scientific and social attitudes tend to be neglected.
4. The lecture method neglects entirely the development of a creative ability on the part of students.
5. The lecture method tends to verbalism. The teacher too often assumes that all students fully understand what he is explaining.

c. Principles for the effective application of the lecture method.

1. Pure lecturing in the lower secondary grades should be avoided.
2. The lecture method should not be used when a topic can be taught by another method. It is often possible to mimeograph the lecture material, and to conduct the lesson in discussion form.
3. If the lecture method is to be used, the following points should be considered:
 - (a) The lecture should not start before the interests of the students are aroused in the topic.
 - (b) While lecturing the teacher should look at the students and should avoid sitting.
 - (c) The lecture should be clearly outlined.
 - (d) The background of students should be considered. The teacher should proceed slowly being sure that students will have enough time to think about the spoken words and to write them down.
 - (e) Monotony should be avoided. The teacher should exhibit a sense of humor and should illustrate some points with appropriate anecdotes.
 - (f) As far as possible the lecture method should include experiments demonstration and other auxiliary teaching aids.

B. The Textbook Recitation Method.

The success of the textbook-recitation method depends largely upon the nature of the textbook used. Unfortunately the biology textbooks used in the secondary schools of Lebanon are inadequate to meet all of the requirements of the proposed biology syllabi in the present thesis. The preparation of a good textbook for the secondary schools

of Lebanon is an urgent need. Before such an attempt is made, biology classes may use whatever is available, or no text at all. The latter is preferable if the teacher is willing to use other sources to prepare the material in mimeographed form. The first year of such an attempt will be rather difficult, but the succeeding years will be much easier.

When textbooks are used the following advantages and disadvantages of the textbook-recitation method should be kept in mind:

a. Advantages of the textbook-recitation method.

1. The textbook-recitation method does not entail any work by the teacher. The material is already prepared, waiting to be assigned.
2. The textbook-recitation method covers more material than other methods.
2. The textbook-recitation method saves time. The students may prepare their lessons at home, and the class period may be used for the discussions of the topic.
4. It is relatively cheap depending only on the price of the textbook.
5. When the textbook-recitation method is properly handed, it trains students in self-education and group discussion. This is one of the most important advantages of this method over the lecture method. In the lecture students depend on their teacher, and they tend to accept the material passively, but in the recitation method the student meets the facts himself and has the opportunity to discuss them in class.

b. Disadvantages of the textbook-recitation method.

1. The success of the textbook-recitation method depends heavily

upon the nature of the textbook. Where a good textbook is not available it tends to be a failure.

2. The textbook-recitation method does not exactly fit the nature of biology students. It is often far too verbal. Students like practical manipulative procedures.
3. The textbook-recitation method depends heavily on the teacher. Lecturing is relatively easier than guiding a good group discussion.
4. The textbook-recitation method is not an adequate method for training the students in scientific attitudes.
5. The textbook-recitation method may not meet the needs of the students and the requirements of the country.

c. Principles for the effective application of the textbook recitation method.

1. A textbook should not be used as crutch. The fact that a topic is discussed in the text does not necessarily mean that it must be taught. The textbook should be used as a guide; the teacher should feel free to change or omit pages, chapters or units.
2. Before a teacher comes to class he should read the assignment and prepare a flexible lesson plan.
3. It is generally conceded to be wise for a teacher to review the past lessons before starting the new lesson, and to summarise the day's lesson before he leaves the classroom.
4. The teacher should not give the impression of dominating the classroom. He should be an "invisible" guide. Students should not feel any tension from a teacher's presence, if they are to

express themselves freely. Stimulative measures rather than restrictive ones should be adopted.

5. The teacher should try to keep all the students interested and active by using the questioning technique properly. The following are some techniques of questioning:
 - (a) The distribution of questions should be equal to all students.
 - (b) Individual differences should be considered by asking the difficult questions to brighter students.
 - (c) Weak students should not be frustrated by a difficult question. They should be helped to give acceptable answers.
 - (d) A student should not be insulted for an odd answer; pains should be taken to show that there is some truth in the answer.
 - (e) The question should always be asked before a student is selected to answer it. This makes all the students think about the question.
 - (f) Simple fact questions about the subject matter of the assignment should be avoided, where possible. Thought questions, the answers of which need a synthesis of a part or parts of the lesson, should be asked.
6. The assignment should be given at the psychological moment. Assignments should not necessarily be made at the end of the lesson, but at any time during the lesson. For example, if the class discussion turns around a topic found in the new lesson, right at that moment the assignment for the new lesson should be given. Students should be motivated for the new lesson, their interests should be aroused to find out what things are found on

the assigned pages. Saying "Your next lesson is from page 6-9" is not educationally acceptable. The assignment is best when the students are motivated and feel a need for it.

7. Monotony in class procedures should be avoided by using demonstrations and other auxiliary teaching aids freely.

C. The Demonstration Method.

Demonstration as a teaching method cannot be used exclusively. But since teachers should make extensive use of it, some of its advantages and disadvantages when compared within the lecture and recitation methods are given below:

- a. Advantages of the demonstration method over the lecture and recitation methods.

1. The demonstration method suits the interests of students. They are always interested in watching things done in their presence.
2. The demonstration method is a better teaching device. Students learn better what they see than what they hear.
3. The demonstration method is an excellent means for motivating the students and arousing their interests in biology or in some units of biology.
4. The demonstration method develops the ability of students to observe, to generalize and to acquire scientific attitudes.
5. The student demonstration method considers individual differences. Brighter students may undertake difficult demonstrations.

6. The student demonstration method trains students in the skill of manipulating laboratory apparatus.
- b. The disadvantages of the demonstration method, when compared with the lecture and recitation methods.
1. The demonstration method is more expensive. It requires the use of laboratory equipment and in some cases expensive apparatus. It should be pointed out, however, that free and low-cost equipment can often be made to do a better teaching job than the more elaborate imported materials.
 2. The demonstration method takes more time. The thing demonstrated may be put in two sentences, but its demonstration sometimes takes two hours.
 3. Like the other methods mentioned, the teacher's demonstration does not fully take into consideration individual differences. In general, all students must see the same demonstration at the same time.
- c. Principles for the effective use of the demonstration method.
1. Demonstrations should always be rehearsed, however simple they may be.
 2. The demonstration should be as nearly infallible as possible.
 3. All the materials needed should be checked before students come in.
 4. The students should be prepared before the demonstrations. The problem must be defined clearly. Students should not be told about the outcomes. Rather, they should be exhorted to observe.

5. The physical condition of the classroom should be appropriate in order to enable all the students to see the demonstration.
6. During the process of demonstration the teacher should check to see if the students are following and understanding it.
7. The demonstration should leave enough time for discussion.
8. As far as possible teacher-demonstrations should be avoided. It is better if the class is divided into groups and the groups demonstrate in turn.

D. The Socialized Method.

One of the most important newer methods of education is the "Socialized Method". Its application in the teaching of biology is justified when its advantages are considered. Some of the common types of socialized methods are:¹

1. Student leadership. A student takes the responsibility of conducting the class. He prepares the plan of the lesson, beforehand with the teacher. During the lesson, the teacher sits at the back. All the class activities, the presentation of the lesson, the discussion of the lesson and the new assignment, are carried on by the student leader of the day. Instead of a single student, a group may be appointed who divide the work among themselves and conduct the class accordingly.
2. Panel discussions. Several students are appointed to discuss a certain topic before the class. Usually they represent several points of view. The class participates by hearing the free give-and-take discussion of the leaders. Such a panel discussion may be necessary when the class divides into several points of view on a certain issue. In order to be efficient each group

1 Bossing, N.L., Teaching in Secondary Schools, 3rd Ed. (Boston, 1952). pp. 158-64.

sends its representative to defend its point of view.

3. **Symposium.** This is an activity in which several students are appointed by the teacher to defend two points of view. Each group prepares the defense beforehand and they carry it through before of the class. During the process each member reads his point of view. After they read their papers, the audience participates by asking questions or by making remarks.
4. **Projects.** This activity does not strictly fall under socialized methods. It depends upon the nature of the project; if it is an activity carried on by a group so that they will present it to the class, it may be considered as a socialized method. Otherwise it should be considered a part of demonstration and/or laboratory methods.

Usually a unit work or a problem of investigation is assigned to a student or group of students, such as the investigation of a certain habitat. The students investigate the problem and present a report on it to the class.

Such socialized methods have their advantages and disadvantages which are given below:

a. **The advantages of the Socialized Methods.**

1. One of the main advantages is the consideration which can be given to the individual differences of the students. The teacher can select the student best fitted to take part in an activity and all the students can thus contribute their best.

2. The socialized method is a highly motivating method. Since the selected student can play his part, he will be interested and motivated in the activities in general.
3. The socialized method is one of the best means of developing socially desirable attitudes in students. Biology should make its contribution to education in general by helping to develop good social attitudes such as cooperative planning, mutual responsibility, respect for others' opinions, honesty and leadership.

b. The Disadvantages of the Socialized Method.

1. Relatively, the socialized method takes a long time to cover a unit; this is perhaps the main reason for its unpopularity as a method.
2. The socialized method is very difficult to control. It is difficult to find teachers who are adequately trained to handle it.

c. Principles for the Effective Use of the Socialized Method.

For the effective application of the socialized method, Bossing suggests the following principles:¹

1. A first principle is to cast the form of organization in as simple a mold as possible.
2. A second principle of conducting the informal type class is that the form employed should be adopted to the needs of the group.
3. A third principle of organization would dictate that organiza-

1 Ibid. pp. 165-9.

tional officers should be few, and that they should be changed frequently.

4. A fourth principle is that the teacher should maintain a vital control of the class as a guide and counselor even though visible control at times be delegated.

E. The Laboratory Method.

The status of laboratory work in the secondary schools of Lebanon suggests a careful consideration of the problem. The comparison of the laboratory with the other methods is given below:

Comparison of the laboratory method with the lecture, recitation and socialized methods:

a. Advantages of the Laboratory Method.

1. The laboratory method fits the nature of students. Laboratory experiments are interesting activities for students.
2. The laboratory method arouses and sustains motivation and interest in the lesson.
3. It is one of the best means for effective learning. If properly done, the students learn better from their own experiments.
4. It trains students in scientific methods: how to observe, and how to draw correct conclusions.
5. It trains students in scientific attitudes, such as precision, suspended judgment, objectivity, accuracy, intellectual honesty.
6. It develops the creative ability of students by providing opportunities to think out and discover new things.

7. It develops an appreciation of scientific literature and advanced research work.
 8. It considers individual differences by assigning proper experiments to each pupil.
 9. It trains students in manipulative skills.
- b. Disadvantages of the Laboratory method.
1. More time is needed to cover a certain unit.
 2. It is more expensive, since it requires laboratory equipment.
- c. The Laboratory Method vs. the Teacher-Demonstration Method.

The Advantages of the Laboratory Method over the Teacher-Demonstration method.

1. The laboratory method fits the nature of students better than the teacher-demonstration method since all students will be performing the activity.
2. The laboratory method is a better means of effective learning.
3. The laboratory method is better than the demonstration method in developing scientific and social attitudes.
4. The laboratory method is better than the demonstration method in teaching reliance on scientific methods.
5. The laboratory method is better than the demonstration method in developing the problem-solving abilities and the creative thinking abilities of students.
6. The laboratory method is better than the demonstration method for developing some of the manipulative skills.

The Disadvantages of the Laboratory Method as Compared with the Teacher Demonstration Method.

1. It takes more time than the demonstration method.
2. The laboratory method is more expensive than the demonstration method, since all the students will need the same apparatus and the same chemicals.
3. The laboratory method is more difficult to control than the demonstration method.
4. The laboratory method requires a special room.

d. Principles for the Effective Use of the Laboratory Method.

1. The teacher should check to see that all the materials to be used in the experiment are available.
2. All the apparatus to be used in the experiment should function well.
3. Students should come to the laboratory prepared for the experiment.
4. The major duty of the teacher should be to motivate the students and arouse their interest in the work, especially at the beginning of the laboratory period.
5. The teacher should be a guide book and not a source book. As far as possible, he should avoid helping the students by giving straightforward answers. He should give help to the extent that the student will be able to experiment and think to find the answer himself.
6. The major attention of the teacher should be the individual student and not the group. Group work is desirable if each

member of the work takes an active part in the experiment, but if it makes some members of the group passive observers, it must be avoided. As far as possible, individual work and achievement should be encouraged.

7. Students should be encouraged to take notes of what they observe and to draw the principal parts.
8. Opportunities should be provided for the students to make discoveries. Verification of established laws is a part of laboratory work, but it is not the essence of it. Also the time and money invested in laboratory work will not be justified if the result is no more than a verification of past findings. Students do not acquire scientific methods merely by observing different kinds of corpuscles in a drop of blood when they have already been told about them and have even seen drawings on the chalkboard. Similarly, there is no advantage in finding that vestigial wings in *Drosophyla* are inherited as a recessive characteristic when the students have already been told about them. Such laboratory experience kills the potentially creative spirit of the laboratory. In order to use the laboratory advantageously, formulation of answers and results in advance of the experiments should be avoided. Students should be told to examine a drop of blood to find for themselves that it contains different kinds of corpuscles. Students should find out themselves whether the inheritance of a certain character is a recessive, a sex-linked or a dominant character. Such experiments constitute genuine laboratory experiences.

3. Other Aspects of Biology Teaching Methods

It is pertinent to make reference here to three further topics under the general heading of "methods":

- A. Audio-visual methods and materials for biology teaching.
- B. Evaluation of the progress of biology students.
- C. The biology teacher.

A. Audio-Visual Methods and Materials for Biology Teaching.

Audio-visual methods and materials are relatively recent developments in education. They are based on the same philosophical and psychological background as other educational activities are: they are not ends in themselves but only means for effective study. As Cole puts it, "The end purpose of audio-visual materials is not to glorify the laboratory, the teacher or the administrator, but to bring about a learning situation in which better teaching may be done to the end that pupils may learn more effectively and more economically."¹

- a. Some of the audio-visual materials useful in biology teaching are:
 - 1. Models and mock-ups.
 - 2. Charts, diagrams, posters and other graphic materials.
 - 3. Films and filmstrips.
 - 4. Lantern slides.
 - 5. Still pictures.
 - 6. Dioramas.
- b. Some of the apparatus often used in audio-visual instruction are:

¹ Cole, W.E., The Teaching of Biology, (London, 1934), pp. 125-6

1. Microscope.
 2. Microprojector.
 3. Opaque projector.
 4. Motion picture projector.
 5. Film strip projector.
 6. Lantern projector.
 7. Mimeograph.
- c. Some of the activities associated with the use of audio-visual materials are:
1. Preparation of any one of the audio-visual materials.
 2. Exhibitions.
 3. Demonstrations.
 4. Preparation of aquaria and terraria.
 5. Preparation of a museum.
 6. Field trips.
- d. The advantages of using audio-visual materials and methods in biology.
1. The use of audio-visual materials suits the nature of students.
As is evident from Table XXIV and XXV, students like to carry on audio-visual activities.
 2. The use of audio-visual materials is in accord with the nature of the learning process, by the use of audio-visual materials students learn more effectively.
 3. The use of audio-visual materials solves the seasonal problems of biology. By means of films and filmstrips it is possible to experience vividly the activities of organism which are not available at all seasons.

4. The use of audio-visual materials solves spatial problems. It brings to class many organisms not available locally. Also it clarifies, by the use of models and mock-ups, the spatial relationships in the development of organisms.
 5. The use of audio-visual materials solves the problem of time and speed. By the use of films it slows the vibrations of the wings of a bee, and accelerates the growth of a tree.
 6. The use of audio-visual materials solves the problem of size. By the use of models it reduces the macroscopic elephant and enlarges the microscopic amoeba to the same size.
 7. The use of audio-visual materials solves the problem of the understanding of complex processes. By the use of charts and films it isolates the factors of the complex process and presents them one by one in their simple forms.
 8. The use of audio-visual materials takes account of individual differences. Students can be selected to take suitable parts in the audio-visual activities.
 9. The use of audio-visual materials is an excellent means to develop socially desirable attitudes in the students.
- e. The limitations of the use of audio-visual materials.

However useful audio-visual methods and materials may be, the following points should be considered for their effective use:

1. The exposure of pupils to visual aids is not a guarantee of successful teaching or of effective learning.
2. Visual aids are not meant to be a substitute for oral and written methods of gaining knowledge or a substitute for direct experience.

3. Visual instruction in the classroom should not be confused with entertainment. Each time an audio-visual material is used, it must have an educational aim.
4. The effectiveness of an audio-visual experience is directly proportional to the degree of its reality. The following is a series in its order of decreasing reality:

A live frog.

A preserved specimen of a frog.

A model of a frog.

A picture of a frog.

The word "frog".

f. Principles for the Effective Use of Audio-visual Materials.

For the effective use of audio-visual activities the following points should be considered:

1. Teacher preparation. The teacher should first set the objectives of the activity. He should evaluate the objectives in terms of the expense and the time spent on the objective. He should try to predict the degree of success in achieving the objectives of the activity. He should prepare all the material means for the students before the beginning of the activity.
2. Class preparation. The first and the most important thing to do is to motivate the class, to arouse their interest in the activity. Then the nature of the activity and its objectives should be clearly explained. Cooperatively with the students the teacher should determine the procedure of the activity, and should divide the students into groups, if necessary.

3. Execution. He should see that all the student participate in the activity with interest. As far as possible he should let the students do the work themselves. He should provide opportunities for reflective thought and creative thinking.
4. Evaluation and follow up. When the activity is over, he should evaluate with the students the work done. He may test the students to discover the benefit they have derived from the activity. And he should suggest improved ways to carry on similar activities in the future.

B. Evaluation of the Progress of Biology Students.

- a. The existing status of the evaluation of biology learning in the secondary schools of Lebanon.

An attempt was made in this study to determine how evaluation is carried on by the biology teachers in the secondary schools of Lebanon. The biology teachers were requested to submit copies of their mid-year biology examinations.¹ Analysis of these examinations reveals the following:

1. There appears to be a disagreement between the opinions of biology teachers with respect to the aims of biology teaching and the evaluation techniques they apply. It was shown that biology teachers do not consider the subject matter particularly important, yet the major emphasis in their evaluation techniques is on written reproduction of factual subject matter. The examinations appear to aim at revealing to what extent biology students have been able to memorize names or other factual material. The intention would appear to be to prepare the students for official examinations. There are some questions which probe for the functional value of a biological topic, but there are almost no questions designed to reveal whether or not students have developed any scientific methods or attitudes. The practice of teachers is thus quite out of harmony with the aims they profess. It is admittedly difficult to measure the progress

1 For examples of biology examinations received, see Appendix D, 3.

of students with respect to some of the aims of biology teaching, but it is preferable to do a right thing imperfectly than to do a wrong thing perfectly.

b. The aims of evaluation in biology teaching.

Some of the aims of evaluation are the following:

1. To determine the degree of the progress of students in attaining the aims of biology teaching.
2. To diagnose those difficulties faced by students which hinder their progress.
3. To diagnose the shortcomings of the biology teacher which hinder the progress of students.
4. To train the students to face problematic situations.
5. To inspire and to motivate the students for future work.

c. Means of Evaluation.

1. Essay type questions. Essay type questions demand descriptive answers, for example: describe the anatomy and the physiology of the human digestive system.
2. Objective type questions. Objective type questions demand clear-cut answers. Some of the most common types are:
 - (a) True or false. A statement is given and the student is asked to indicate whether it is true or false.
Example: T.F. All cells contain one or more nuclei.
 - (b) Multiple choice. Several answers are given to a question and the student is told to select the best answer.
Example: Which is the strongest chamber of the heart? (1) the left ventricle, (2) the left auricle, (3) the right auricle, (4) the right ventricle.

(c) Matching. Two columns are given with a certain number of items in each. Students are told to indicate the corresponding items in the two columns. Example:

- (1) Cytology—study of fossils
- (2) Paleontology—study of diseases
- (3) Pathology—study of cells

(d) Completion. A given statement is left incomplete. The pupil is told to complete it.

Example: Cells which carry oxygen are called.....

Many other types of objective tests can be constructed by any biology teacher, for example:

- (a) A diagram may be given to be labeled.
- (b) Students may be told to select the idea which includes at least two other ideas in a given series.

Example: Metaphase, Mitosis, Telophase, Symbiosis, Cytolysis.

- (c) Students may be told to arrange the following in the chronological order of their action on food: trypsin, erepsin, ptyaline, pepsin.

3. Behaviour Tests.

(a) Direct oral tests. A student is called on and asked a question. The student is expected to respond orally immediately afterwards.

(b) Indirect behaviour tests. These involve the evaluation of a student's work without his knowledge, such as:

- (1) The attitude of the student towards the lesson.
- (2) The behaviour of the student in the class or in the laboratory.

- (i) Does he conform to the rules of healthy living?
- (ii) Does he observe independently to discover things for himself?

(3) An interview with the student.

d. Evaluation of the different types of tests.

1. Essay type tests.

Advantages of essay type tests:

- (a) Essay type tests are usually easy to prepare.
- (b) Essay type tests train the students in self-expression and organisation.

Disadvantages of essay type tests:

- (a) Essay type tests tend to emphasize subject matter.
- (b) The evaluation of the teacher tends to be subjective.
- (c) The correction tends to take a long time.
- (d) Essay type tests tend to represent only a part of the lesson.
- (e) Essay type tests tend to be monotonous.

2. Objective type tests.

Advantages of objective type tests:

- (a) The objective type test is easily corrected.
- (b) The evaluation of the teacher tends to be objective.
- (c) The objective type tests tend to represent all the lesson.
- (d) The objective type test tends to be more appealing to students, than the essay type test.
- (e) The objective type tests tend to be far more valid and reliable than essay type tests.

Disadvantages of objective type tests:

- (a) The objective type tests tend to emphasize subject matter.
- (b) The preparation of objective type tests takes a long time, and much experience is required for writing dependable items.

3. Behaviour tests.

Advantages of direct oral tests:

- (a) Direct oral tests train students in self-expression.
- (b) All forms of cheating are checked.
- (c) The teacher does not spend time on correction.

Disadvantages of direct oral test:

- (a) The evaluation of the teacher tends to be subjective.
- (b) The direct oral test tends to be unreliable, since each student answers only two or three short questions.
- (c) Direct oral tests are often unfair. The first students always answer new questions, while those who answer later are likely to have had time to prepare adequate answers to the similar questions they will receive.
- (d) The psychological effect of the direct oral tests is not appealing. The hour of testing leaves the impression of the "judgment seat".
- (e) During the oral examination, it becomes rather difficult to control the class.

Advantages of indirect behaviour tests:

- (a) Indirect behaviour tests tend to reveal the progress of students in acquiring scientific methods and attitudes.
- (b) Indirect behaviour tests tend to reveal better to what extent students practise in their daily lives what they have learned in school.

Disadvantages of indirect behaviour tests:

- (a) Indirect behaviour tests tend to be subjective.
- (b) Indirect behaviour tests may leave the feeling of favoritism.

e. Some suggested principles for the effective application of evaluation in biology teaching.

1. The teacher should avoid leaving the impression that he is a judge.
2. The teacher should try his utmost to be entirely fair.
3. The teacher should be aware of the possible limitations in his own measurement techniques when trying to evaluate students.
4. The teacher should have an aim in asking a question. The aims of biology teaching should be borne in mind, and any good question will reflect one or more of them.
5. The teacher should consider evaluation as a process of educating the pupil as well as measuring the results of education.
6. The teacher should avoid oral tests insofar as possible, due to the seriousness of their disadvantages.
7. The teacher should use both essay type and objective questions in order to capitalize on the obvious advantages of both.

C. The Biology Teacher

The teacher is the chlorophyl of the teaching process. It is truly said, "The teacher is by all odds, the most influential factor in high school education. Curriculum, organization, equipment, important as they are, count for little or nothing except as they are vitalized by the living personality of the teacher."

This section is organized along the following lines:

- a. A description of present day biology teachers in the secondary schools of Lebanon.
 - b. The qualities of a good biology teacher.
 - c. Some principles for the effective influence of the teacher.
- a. A description of Present Day Biology Teachers in the Secondary Schools of Lebanon.

Biology teachers were investigated with respect to the following:

1. Experience and teaching load.
2. Educational qualifications.
3. Courses taken.

1. Information about the experience and the teaching load of the biology teachers.

38 biology teachers were asked how many years of teaching experience they had had, whether they were full-time or part-time teachers, and what courses they taught. Table XXVII represents their responses.

TABLE XXVIITHE TEACHING EXPERIENCE OF THE BIOLOGY TEACHERS STUDIED

1. Teachers classified by number of years of teaching experience.

<u>Years</u>	<u>Number of teachers</u>
10 or more	4
8-9	2
6-7	6
4-5	2
2-3	15
1	3

2. Courses taught by the biology teachers studied.

<u>Courses</u>	<u>Number of full-time teachers</u>	<u>Number of part-time teachers</u>	<u>Total</u>
Only Biology	3	12	15
Biology and Physical Science	4	5	9
Biology and Arts Courses	1	2	3
Biology and miscellaneous	9	1	10

3. The educational qualifications of the biology teachers.

Table XXVIII presents the degrees held by the 37 biology teachers.

TABLE XXVIIIDEGREES HELD BY THE BIOLOGY TEACHERS STUDIED

<u>Degrees</u>	<u>Number of teachers</u>
B.A.	13
Sophomore Diploma	6
N.C.	6
Baccalaureat II	5
M.D.	4
Ph.C.	1
Nursing	1
M.S.	1

3. The courses biology teachers have taken.

To find out the training of biology teachers, a list of courses was presented to them bearing the following instruction:

"The following is a list of courses above high school level followed by four blank columns. For each course please put a check mark (✓). Put the check in the first column if you have not taken that course. Put the check in the second column if you have taken that course, but you think you need more training in that course as a biology teacher. Put the check in the third column if you think that your training in that course has been more than necessary. Put the check in the last column if you think your training in that course has been neither more nor less than your need."

The teachers were requested to add to the list any educational or biological courses they had taken which were not included in the list. Table XXIX represents the responses of 38 biology teachers.

TABLE XXIXCOURSES TAKEN BY THE BIOLOGY TEACHERS IN THE STUDY

<u>Name of Course</u>	<u>Number of Teachers</u>			
	<u>Not taken</u>	<u>Need more</u>	<u>Need less</u>	<u>Same as obtained</u>
General Biology	1	4	17	12
General Zoology	4	7	13	11
General Botany	2	8	15	11
Anatomy	7	4	12	12
Embryology	9	7	9	8
Physiology	5	5	15	10
Genetics	5	5	11	13
Evolution	10	6	11	7
Entomology	13	11	7	3
Bacteriology	10	6	12	7
Biochemistry	8	5	12	9
Psychology of Education	11	7	9	8
Philosophy of Education	15	5	7	7
Practice Teaching	16	4	7	9
Science Teaching	17	2	13	4
Audio-visual education	17	8	6	5
General Psychology	3	3	17	11
Psychology of Adolescence	12	3	10	11
General Chemistry	3	2	10	4
General Physics	5	2	9	2

The courses added to the list by teachers were:

<u>Course</u>	<u>Number of teachers</u>
Laboratory technique	3
Paleontology	2
Hygiene	2
Histology	1
Statistics	1
Pathology	1
Histology	1
Psychology of Development	1
Food and Nutrition	1
Parasitology	1
Pharmacology	1

It should be noted that half of the biology teachers are not trained in the theory and practice of education. It is worth noting also among the teachers who had taken the courses on the list, 14 out of the 20 courses were subjects in which the plurality of teachers deemed that they had already studied more than enough.

b. The qualities of a good biology teacher.

1. A good biology teacher should have a philosophy of life and education to guide his actions. Every moment he should endeavor to train his students according to his conception of the ideal citizen. He should consider the nature of the course, the extent of the subject matter and the nature of the methods applied as means to attain the goals of life.
2. A biology teacher should have a good knowledge of the biological sciences and should be well-trained in the principles of psychology and education.
3. A biology teacher should be well-trained in scientific methods and attitudes. He should be a scientist, so that he may inspire the student in scientific research.
4. The biology teacher should have a personality characterized by the following traits:
 - (a) Flexibility.
 - (b) Industriousness.
 - (c) Leadership.
 - (d) Impartiality.
 - (e) Enthusiasm.
 - (f) Sympathy.

- c. Some principles for the effective influence of the teacher are:
1. The teacher should try to win the confidence of the students.
 2. He should not be sarcastic.
 3. He should be fair. Favoritism destroys the confidence of students in their teacher.
 4. He should have private interviews with students.
 5. He should leave an invisible social distance between him and students, so that students will feel free to cooperate freely but will at the same time respect the fact that he is not one of their classmates.
 6. He should exhibit a sense of humor in the classroom.
 7. He should give his students an awareness of the fact that he believes they are important people.
 8. He should take the individual differences of his students into consideration.
 9. He should develop the habit of self-appraisal so as to know his weaknesses.

4. Recommended Methods for Some Special Topics.

Each topic in biology needs an extensive study which is outside the scope of the present thesis. For practical purposes only a few guiding principles will be mentioned for each of the following topics:

- A. Hygiene
- B. Conservation
- C. Embryology
- D. Heredity
- E. Scientific methods

A. Suggestions for Teaching Rules of Hygiene.

1. Before a hygiene rule is taught the students should know the structure and the functioning of the parts involved. For example, if the hygienic rule is about the nature of food, students should know the parts and functions of the digestive tract.
2. The students should know the reason behind the practice of a hygienic rule. For instance, if they are told to chew the food well, the advantage to be gained in salivary and gastric digestion should be pointed out.
3. The students should practise the rule in the classroom. If the teacher explains how to brush the teeth, the students should bring their brushes and tooth paste and practise with the teacher in the classroom.
4. The teacher should see that students apply the rules in their daily lives. If a rule is only memorized, or if it is practised several times and then neglected, it will have no value. The teacher should whenever possible, check to see that the rules are

being applied in actual behaviour. This often necessitates close cooperation with parents.

5. The rules should not be presented to students verbally; as far as possible they should be presented by a teaching aid, films, posters and charts. These are good means for motivating the students to apply the hygienic rules they present.

B. Suggestions for Teaching Conservation.

Conservation is not subject matter to be learned by students; it is rather a state of mind which must be developed in students. This fact makes it difficult to teach, however the following points can be useful.

1. Students should have a knowledge of the biological resources of the country, and of the regulations regarding hunting, fishing, and destruction of plants.
2. Students should understand the importance of the natural resources.
3. Students should appreciate the existence of other forms of life.
4. Probably the best method and the best opportunity to teach conservation is on field trips.

A. J. Gustafson in his doctoral thesis concludes, "Extra-curricular activities which combine recreation and nature study in an informal way are far superior media by which proper conservation attitudes and ethics can be developed than are the traditional methods of classroom and laboratory instruction."¹

1 Blackwood P.E. and Brown, K.E., "Science Education Research Studies - 1954", Science Education, LIX, 1955, p. 379.

C. Suggestions for Teaching Embryology.¹

The main difficulty in teaching embryology is the spatial relationships involved and the dynamic nature of the process. To solve these problems the following points should be considered:

1. Models and mock-ups of embryos should be used extensively.
2. Students should be trained to perceive the relationships of different sections; if a longitudinal section of an embryo is presented, they should be encouraged to see how the cross section would appear.
3. In using the microscope students should be encouraged to practise differential focusing to see how other parts of the object appear.
4. The teacher should try to prepare pictures which give a three-dimensional effect. For this purpose stereograms are very helpful.
5. Films should be used widely, especially to speed up the motion of embryonic development.
6. By the use of a microprojector, episcoper or a camera, series of diagrams showing the developmental stages can be prepared.

D. Suggestions for Teaching Dissection.

Green gives the following techniques for dissection:²

1. "Describing the main features which are displayed. These can be illustrated by a quickly-made diagram and by a completed

1 Adapted from Green, T.L., The Teaching and Learning of Biology in Secondary Schools, (London, 1954), p. 186.

2 Ibid. p. 161.

dissection—for this purpose one can from year to year preserve the better examples amongst the pupils' work.

2. Make a few comments about any steps which will be taken as important landmarks, and point them out in a whole specimen, in a dissection (if still visible), and by means of a sketch (e.g. the use of the vasa differentia in the earthworm for segmental location).
3. Describe the first step in dissection, carry it out stage by stage with suitable comments, naming the structures which are displayed and make a rough sketch of the main theme.
4. At this point the pupils repeat on their own specimen what their teacher has done and they can refer to his work, to his sketch, and to whatever demonstration material has been considered necessary. They must make serial sketches of the progress of their work. It is well to name a time limit.
5. Further demonstration by the teacher, followed by the students, are carried out until the work is completed.
6. At the end of this kind of demonstration each student should have moved logically from step to step, knowing what the organs encountered were, appreciating the significance of each movement, making notes on method and preparing diagrams which allow him to follow the whole sequence easily later on. Thus he is preparing for revision by collecting suitable data and by doing the work upon an intelligent plan to begin with."

E. Suggestions for Teaching Scientific Methods.

The scientific method is not a way of doing but a way of thinking. This fact makes its teaching more difficult. However, the following points may be useful:

1. The personality of the teacher in teaching scientific method is one of the most effective factors. The teacher should be a living example before the students of the application of scientific methods in the life.
2. The activities of the students should be planned specifically to provide opportunities for the successful use of scientific methods.
3. The acquisition of the skill to apply scientific methods should not be thought of as being a concomitant result of students' experience in a logically organized subject matter; it must be directly taught. Statistically, significant progress has been obtained when scientific methods are specifically taught for.¹
4. Teachers should train students in the skill of wide reading. A study made by Curtis has given clear evidence that pupils who engage in wide reading in general science develop scientific attitudes to a greater extent than those who study only a single text.²
5. It is the personal opinion of the present writer that while a great deal may be said for the above-mentioned four points,

1 Blackwood, P.E. and Brown, K.E., "Science Education Research Studies - 1954", Science Education, LIX, 1955, p. 378.

2 Heiss, E.D. et al, Modern Science Teaching, (New York, 1950), p. 130.

yet the best means to train students in scientific methods is laboratory work.

The following traditional objectives of the laboratory are not deemed to be valid:

- (a) To have a pleasant time in the laboratory by seeing interesting organisms.
- (b) To motivate the students in their studies.
- (c) To provide a means to clarify the lesson.
- (d) To verify what has been proved in the past.

Laboratory exercises should be characterized by problematic situations. Students should undergo rigorous and creative thinking and they should be encouraged to discover something new.

Telling the nature of the inheritance of a certain character and urging the students to verify it does not result in scientific training. The teacher should provide all the means and should leave the student himself to discover the nature of the inheritance of the character. It is a genuine discovery for the student even though it may have been discovered before.

In the North Central Conference on Biology Teaching conducted by the National Association of Biology Teachers, the following recommendations were made in answer to the question, "How can we teach scientific methods and develop scientific attitudes?"¹

"Recommendations: The Conference recommended that biology instruction be so directed that it will develop in high school students

1 "Report of the North Central Conference on Biology Teaching", *The American Biology Teacher*, XVIII, 1956, p. 49-50.

scientific methods, approaches, and attitudes through any, all or any combination of the following devices:

1. By showing students that the methods used in the biological and physical sciences need not necessarily be confined to these areas.
2. By the example of the teacher who, himself, uses the methods, approaches, and attitudes of scientists.
3. By references to the classics of science and the manner in which scientists attacked their problems.
4. By providing opportunities in class or clubs for experiences in using scientific methods in securing answers to questions raised, in minds of students, by skillful teaching.
5. By relating, throughout the course, the subject matter of biology to the methods of science.
6. By recognizing that a test of effective teaching in this area is the ability of the student to apply scientific attitudes to his daily problems.
7. By field study of zonation and succession in various ecological habitats.
8. The opportunity should be provided to study world-wide science and to see that science is a product of all races and nations.
9. By carrying on long-time projects involving a problem studied by successive classes over a period of years."

SUMMARY OF PART III

Part III of the thesis dealt with methods of biology teaching with respect to the existing status of the methods of biology teaching in the secondary schools of Lebanon, the methods of biology teaching in modern educational thought and the recommended methods of biology teaching for the secondary schools of Lebanon.

Chapter VII presented the status of biology teaching methods in the secondary schools of Lebanon. It examined the methods applied by 38 biology teachers, some biology classroom activities and the biology laboratory. In general, the major methods practised by the biology teachers are the lecture and textbook recitation. Biology teachers do not undertake classroom activities other than formal teaching periods. The majority of the schools do not have a biology laboratory and laboratory equipment.

Chapter VIII presented the methods of biology teaching as endorsed by modern educational experts. It discussed the following criteria for the selection of the methods of biology teaching: the aims of biology teaching, the nature of the subject matter, the nature of the learning process and the psychology of students. It attempted to show how the aims, the subject matter, and the nature of the learner affected the nature of the method. After discussing briefly some of the theories of learning, it presented some conditions under which learning would take place more effectively.

Chapter IX, after comparing briefly the status of biology teaching in the secondary schools of Lebanon and in modern educational thought, pointed out that biology does not have a special method of its own, but that it uses all the methods in their appropriate time and place. Therefore it discussed the advantages, the disadvantages, and the principles for the effective use of the lecture, recitation, demonstration, laboratory and "socialized" methods.

Considering the influence of some other factors on the methods of biology teaching it presented briefly the following: the advantages, the limitations, the methods and materials and the principles for the effective use of audio-visual aids; the aims of evaluation, the types of evaluation procedures and the principles for the effective evaluation of student progress; the biology teachers in the secondary school, the qualities of a biology teacher and some principles for maximum effectiveness of the biology teacher.

The chapter closed with a brief discussion of some suggested methods for teaching hygiene, conservation, embryology, dissection and scientific methods and attitudes.

PART IV

A LOOK TO THE FUTURE OF BIOLOGY TEACHING IN LEBANON

CHAPTER X

A LOOK TO THE FUTURE OF BIOLOGY TEACHING IN LEBANON

The present chapter is an attempt to present suggestions for the improvement of biology teaching in Lebanon. The suggestions will be presented in the following order:

1. Suggestions from students and teachers.

A. Suggestions made by biology students in secondary schools of Lebanon.

B. Suggestions by Freshman and Sophomore students in A.U.B.

C. Suggestions by biology teachers.

2. Recommendations.

1. Suggestions from Students and Teachers

A. Suggestions by secondary school biology students.

About 500 biology students in various secondary schools of Lebanon were asked what suggestions they would make to a graduate student to help him to become a good biology teacher.¹ Their responses are classified in Table XXX.

1 Appendix A, 3.

TABLE XXX

SUGGESTIONS MADE BY ABOUT 500 STUDENTS TO HELP A PERSON TO BECOME
A GOOD BIOLOGY TEACHER

What kinds of things should a good biology teacher do?

<u>Suggestion</u>	<u>Number of students mentioning</u>
1. Have laboratory experiments often	162
2. Explain the lesson fully so that all students may understand	112
3. Do research work similar to the present questionnaire so as to understand students better	79
4. Be friendly with students	57
5. Use audio-visual materials extensively	52
6. Be a specialist in his subject	44
7. Try to make the lesson easy	32
8. Be patient with students	28
9. Develop a good personality	21
10. Be industrious	19
11. Make the lesson interesting	19
12. Have a sense of humor during the lesson period	17
13. Be fair in your evaluations	17
14. Have a teaching plan before you come to class	12
15. Encourage students by giving high marks	10
16. Like the subject you teach	8
17. Develop the ability to control the class	7

<u>Suggestion</u>	<u>Number of students mentioning</u>
18. Be married to explain some topics freely	7
19. Summarize the lesson at the end of the period	7
20. Let the goal of your teaching be the student's development	7
21. Develop your instruction language well	5
22. Ask advice from specialists	5
23. Ask questions often	5

29 other suggestions were made by less than 5 students each.

It is significant to note that students want to have the lesson fully explained; the use of the laboratory method and audio-visual methods are strongly recommended by them.

Students want to reveal their interests and needs to their teachers. They expect to establish friendship with them, to talk to them freely. Students want their teachers possess a good personality.

B. About 100 Freshman and Sophomore students at A.U.B. were asked what suggestions they had for improving the biology teaching in their secondary schools. Their responses are classified in Table XXXI.

TABLE XXXI

SUGGESTIONS BY 97 FRESHMAN AND SOPHOMORE STUDENTS AT A.U.B. FOR
IMPROVING THE TEACHING OF BIOLOGY IN THE SECONDARY SCHOOLS
THEY ATTENDED

<u>Suggestions</u>	<u>Number of students mentioning</u>
1. Have more laboratory work	61
2. Use audio-visual methods and materials more extensively	26
3. Give quizzes more often	16
4. Try to have the lesson understood by students, and not merely memorized	12
5. Consider the maturity of students	11
6. Use a better textbook	10
7. Try to eliminate technical names	9
8. Consider the quality and not the quantity of what is taught	8
9. Guide students by giving them projects	6

30 other suggestions were made with frequencies less than 5.

It is noteworthy that students at the A.U.B. recommend the same methods mentioned by students in secondary schools for biology teaching. They tend to emphasize the quality rather than quantity of biology instruction.

C. Suggestions by biology teachers.

38 biology teachers were asked what suggestions they had for improving the teaching of biology in the secondary schools of Lebanon. Their responses are classified in Table XXXII.

TABLE XXXII

THE SUGGESTIONS OF 38 BIOLOGY TEACHERS FOR IMPROVING THE TEACHING
OF BIOLOGY IN THE SECONDARY SCHOOLS OF LEBANON

<u>Suggestion</u>	<u>Number of teachers</u>
1. To have a well-equipped laboratory	12
2. To use audio-visual materials more extensively	10
3. To be a specialist in the subject	5
4. To have a biology textbook specially prepared for the secondary schools of Lebanon	3
5. To consider biology to be the major science in the secondary schools	3
6. To teach biology for more than 1 year	3
7. To have a good Arabic-English dictionary of biological terms	2
8. To make students less grade-conscious	2

11 other suggestions were made with frequencies of 1.

The biology teachers approve the suggestions proposed by biology students for the extensive use of the laboratory and audio-visual methods. They also agree that teachers should be well-trained in biological subject matter. In addition to the suggestions made by biology students, biology teachers want to have biology textbooks especially written for Lebanon.

2. Recommendations.

To improve the teaching of biology in the secondary schools of Lebanon, the following recommendations are made:

1. The main aim of principals and biology teachers should be the development of students to enable them to make desirable adjustments in life. For this, the training of students to meet their biological needs and to develop scientific attitudes should receive a primary emphasis.
2. The program in subject matter of biology should be constructed around the axis of life functions. The physiology, hygiene and pathology of the human body should occupy a prominent place.
3. If possible, the program of general science in the first four grades of secondary schools should be constructed around the axis of biology. The following biology schedule is recommended for secondary schools:

First year: 2 periods of discussion and demonstrations.

Second year: 2 periods of discussion and demonstrations.

Third year: 2 periods of discussion and 1 period for student demonstrations.

Fourth year: 2 periods of discussion and 90 minutes of laboratory.

Sixth year: 1 period of discussion and 120 minutes of laboratory.

4. The biology teachers should be well-trained both in their

subject matter and in education. They should have taken at least a semester course in each of the following university courses:

1. General Botany
 2. General Zoology
 3. Human Physiology
 4. Human Pathology
 5. Hygiene
 6. Genetics
 7. Evolution
 8. Technique of slide preparation and preservation of specimens.
 9. Ecology
 10. General physics
 11. General Chemistry
 12. Psychology of Education
 13. Philosophy of Education
 14. Science Teaching
 15. Biology Teaching
 16. Audio-visual methods and materials
5. With respect to imposed requirements the following recommendations are made:
- a. Lebanese Baccalaureat Program. The biology syllabus should be reorganized. The most important of the recommended changes are:
 - (1) Biology should be included in the Baccalaureat examination.
 - (2) Its biology subject matter content should be revised.¹

1 See Chapter VI

(3) It should demand a special laboratory for biology.

b. American University of Beirut.

(1) A syllabus for biology should be prepared for the approved secondary schools, and A.U.B. should administer appropriate tests to determine whether the syllabus is being adequately implemented by each school.

(2) In A.U.B. entrance examinations, students should be required to take two subjects out of the following three: Biology, Chemistry, Physics. An entrance examination in General Science should be obligatory and it should be prepared in such a way that a student with no knowledge of biology will fail.

(3) A.U.B. should accept students only from secondary schools which offer laboratory work in biology.

c. General Certificate Examinations. There is no reason why schools in Lebanon should fulfill the requirements of the General Certificate Examinations, because it is not imposed by the Lebanese government.

6. There is an urgent need for the preparation of a good biology textbook especially prepared for the secondary schools of Lebanon.

7. The Education and the Biology Departments at A.U.B. should cooperate in preparing biology teachers. The Education Department should have a well-equipped laboratory for teacher-

training students or it should use one of the laboratories of the Biology Department. The Biology Department should offer, especially for education students, a course called "The hygiene and the pathology of school children".

8. It is suggested that a secondary school biology (or science) teachers association be organized; preferably the Education Department at A.U.B. should undertake its creation and functioning. The main job of the association would be:
 - a. To prepare a biology textbook for secondary schools.
 - b. To publish a biology magazine for secondary schools students and teachers, and a teachers' guide in biology.
 - c. To prepare an Arabic-English dictionary for biological terms.
 - d. To improve the teaching of biology in the secondary schools of Lebanon.
 - e. To encourage talented young students to be biologists in the future.
 - f. To open an audio-visual center for the use of secondary schools.

9. It is recommended that each secondary school should have its biology laboratory. Recommended laboratory equipment per 24 students is as follows:
 - a. 12 compound microscopes
 - b. 12 dissecting microscopes
 - c. 1 microprojector
 - d. 24 dissecting sets.
 - e. 12 sets of zoology microscope slides, 50-75 slides per set.

- f. 12 sets of botany microscope slides, 25-50 slides per set.
- g. 12 sets of human physiology microscope slides, 20-30 slides per set.
- h. 12 dissecting pans
- i. 50 zoology, botany and physiology wall charts
- j. 2 stethoscopes

The following audio-visual materials can be prepared satisfactorily by the students:

- a. Insect killing jars
- b. Aquaria
- c. Terraria
- d. Models
- e. Incubators
- f. Insect collecting bags
- g. Some of the charts
- h. Some of the slides

The following pieces of audio-visual apparatus are very useful.

- a. Motion picture projector
- b. Filmstrip projector
- c. Opaque projector
- d. Films and filmstrips

Designs for two kinds of biology laboratory are reproduced in figures 8, 9, and 7. Schools having sufficient funds may design their laboratories according to figures 7 and 8, while those with limited funds may use their biology classroom for a laboratory by making slight modifications. Figure 9 presents the recommended modifications.

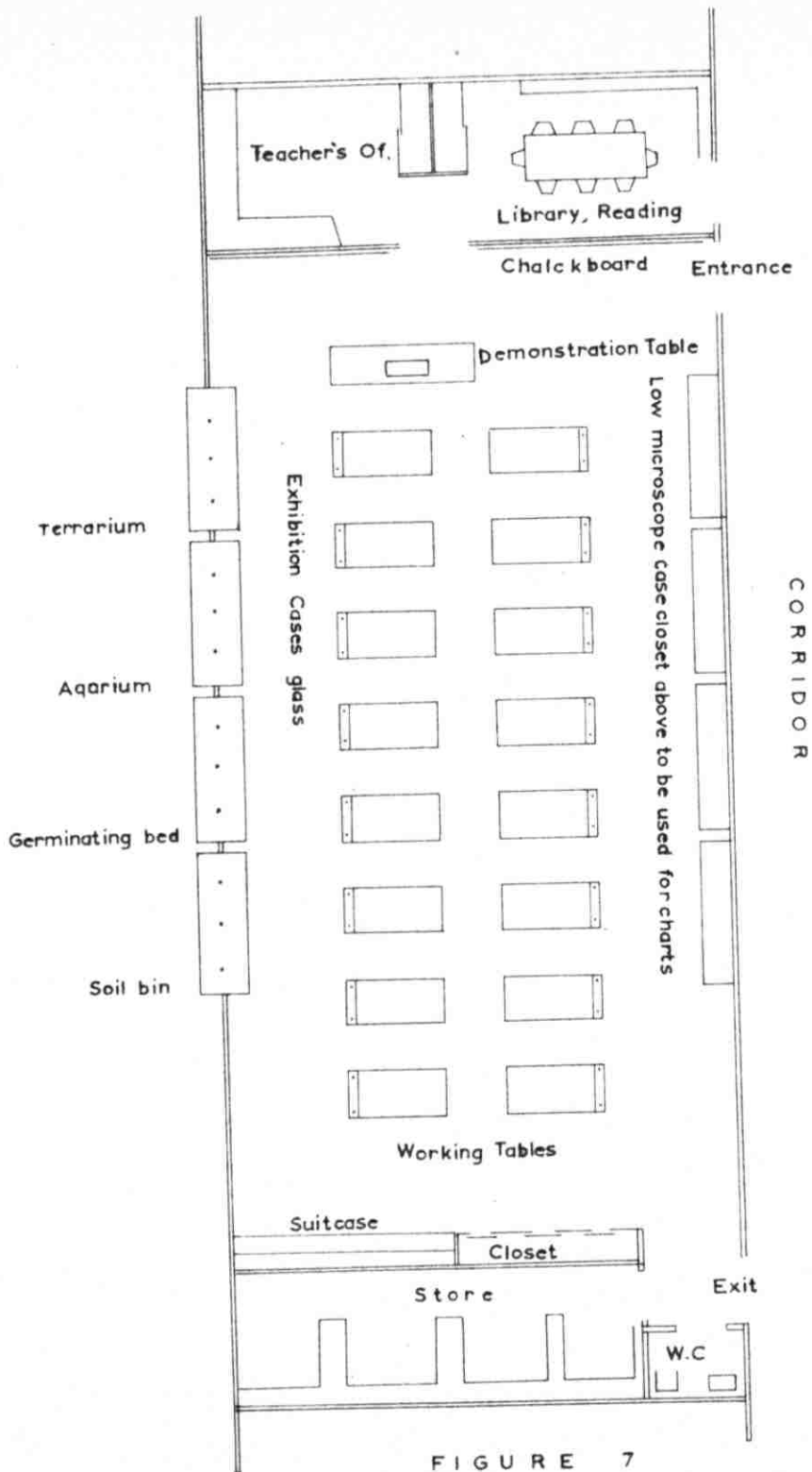


FIGURE 7
FLOOR PLAN OF BIOLOGY LABORATORY

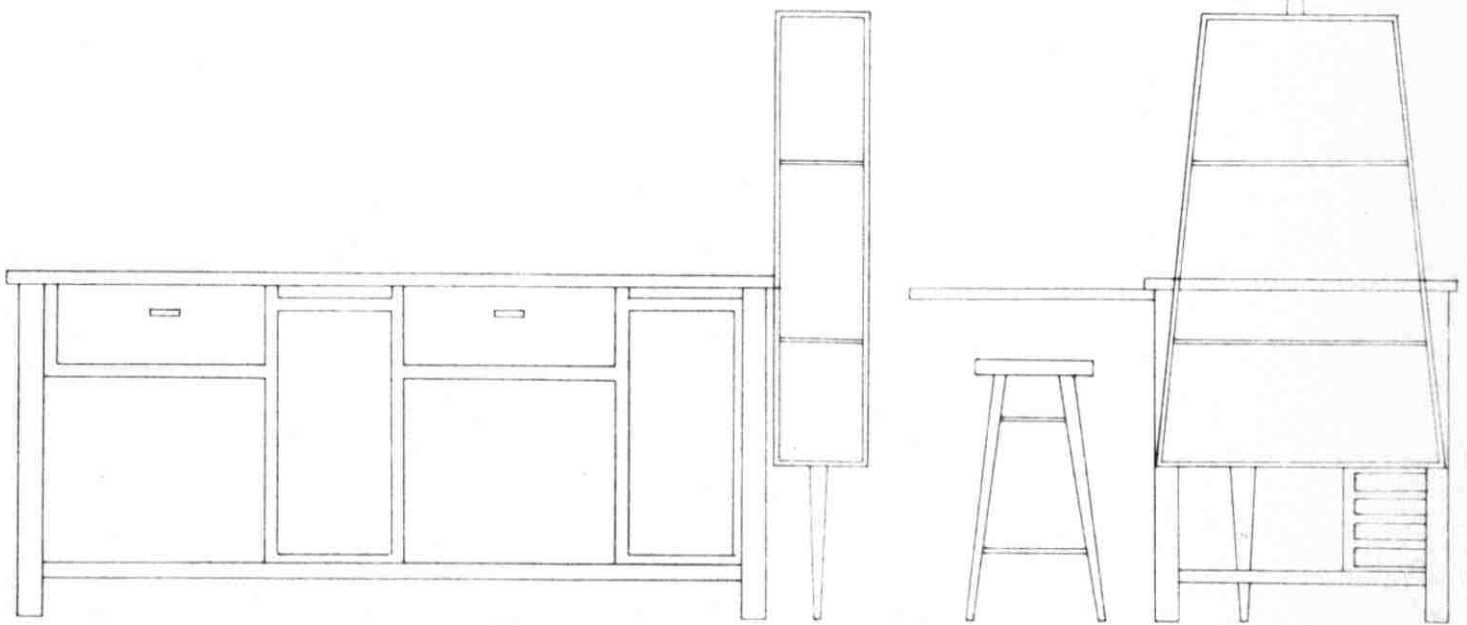
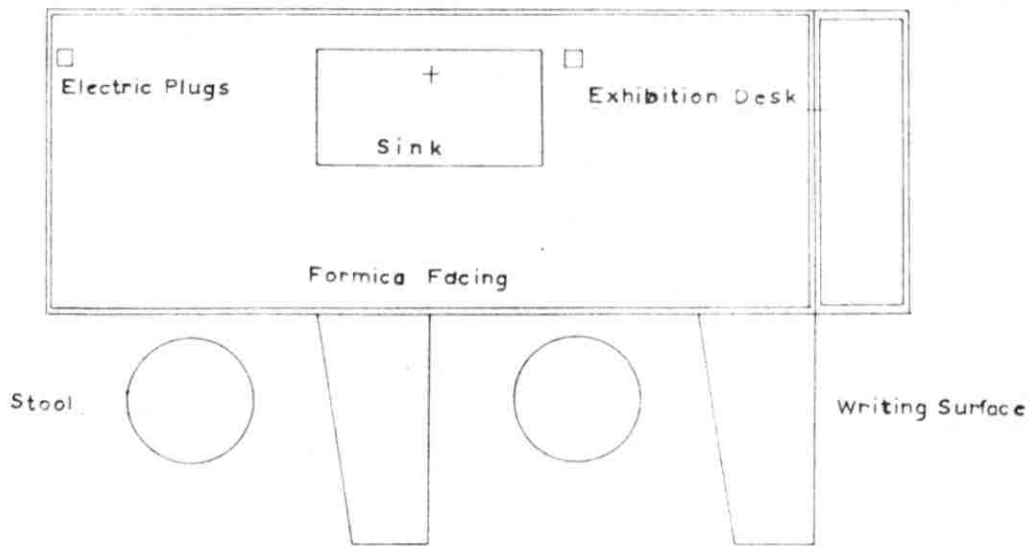


FIGURE 8

FRONT ELEVATION

SIDE ELEVATION

LABORATORY TABLE

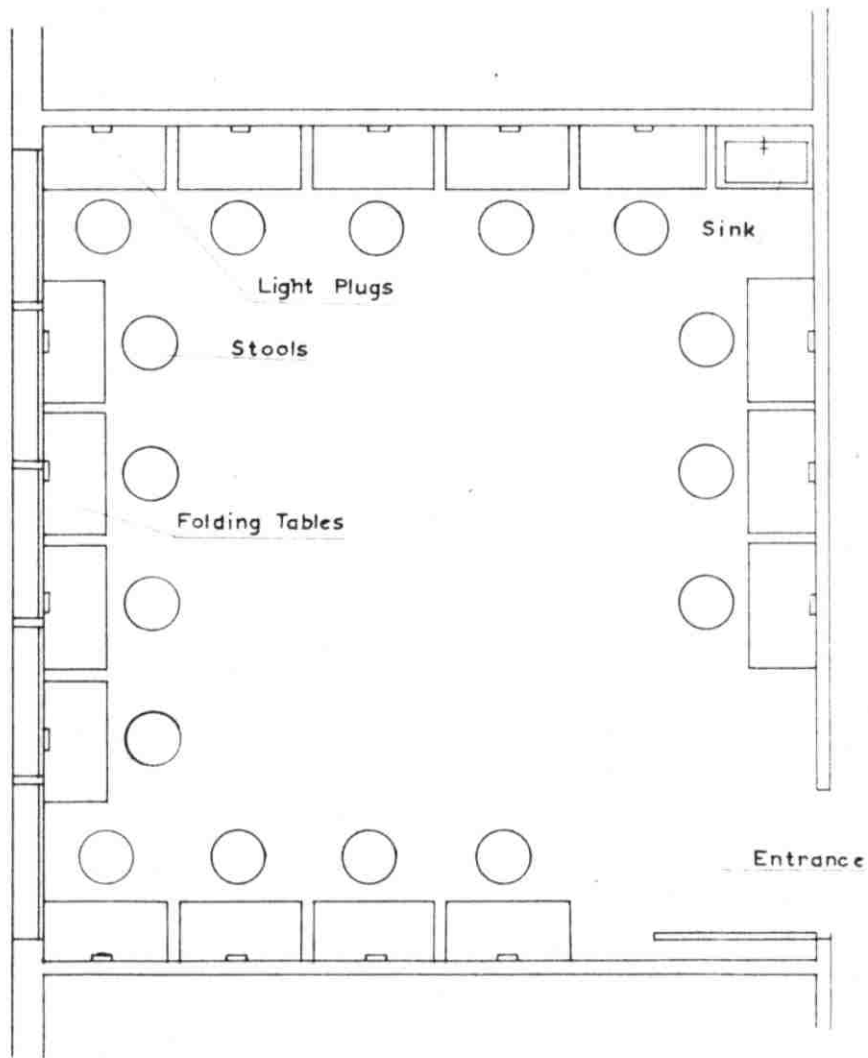


FIGURE 9
PLAN OF A MODIFIED BIOLOGY CLASS ROOM FOR
LABORATORY EXPERIMENTS

PART V

SUMMARY AND CONCLUSIONS

SUMMARY

In the present thesis, biology teaching was discussed along three main lines:

1. The Aims of Biology Teaching
2. The Subject Matter of Biology Teaching
3. The Methods of Biology Teaching

Part I presented the aims of biology teaching. Chapter I presented the status of the aims of biology teaching in the secondary schools of Lebanon with respect to:

1. The opinions of 38 biology teachers on the aims of biology teaching.
2. The opinions of 500 biology students on the aims of biology teaching.

Chapter II presented the following criteria for the selection of the aims of biology teaching by modern educational specialists:

1. The aims of education
2. The aims of science teaching
3. The aims of secondary education
4. The educational philosophy of Lebanon

Chapter III compared and contrasted the opinions of biology teachers with the opinions of modern educational specialists, and recommended aims of biology teaching in Lebanon were outlined.

Part II dealt with the subject matter of biology teaching.

Chapter IV presented the status of the subject matter of biology teaching in the secondary schools of Lebanon with respect to:

1. The opinions of 38 biology teachers on the criteria for the selection of subject matter of biology.
2. The opinions of 38 biology teachers on the importance of some units of subject matter of biology.
3. The evaluation by biology teachers of the biology textbooks now used in Lebanon.
4. The grade level of biology teaching in the secondary schools of Lebanon.

Chapter V presented the following criteria for the selection of the subject matter of biology by modern educational specialists:

1. The aims of biology teaching
2. A theory of knowledge
3. The nature of biology students
4. The imposed requirements in Lebanon

Chapter VI compared and contrasted the opinions of modern educational specialists on subject matter of biology with the opinions and practices of biology teachers of Lebanon, and recommended a syllabus in biology for the secondary schools of Lebanon.

Part III dealt with the methods of biology teaching.

Chapter VII presented the status of the methods of biology teaching in the secondary schools of Lebanon with respect to:

1. The general methods reported to be in use by 38 biology teachers in the secondary schools of Lebanon.
2. The nature of the actual teaching procedures of the 38 biology teachers in their classrooms.

3. The laboratory and the laboratory equipment of secondary schools.

4. The organisms examined in laboratories.

Chapter VIII presented the following criteria for the selection of the methods of biology teaching by modern educational specialists:

1. The aims of biology teaching
2. The nature of the subject matter taught
3. The nature of learning processes
4. The nature of the learner

Chapter IX dealt with methods of biology teaching, as follows:

1. The advantages, the disadvantages and the principles for the effective use of:
 - a. The lecture method
 - b. The recitation method
 - c. The demonstration method
 - d. The laboratory method
 - e. The socialized method
2. Some other aspects of methods for teaching biology, such as:
 - a. Audio-visual methods and materials
 - b. Evaluation
 - c. The biology teacher
3. Specific suggestions for teaching some units of biology, such as:
 - a. Hygiene
 - b. Conservation
 - c. Embryology
 - d. Heredity
 - e. Scientific methods

Part IV presented general suggestions for the improvement of biology teaching in the secondary schools of Lebanon, as made by:

- a. Secondary school biology students
- b. A.U.B. Freshman and Sophomore students
- c. Secondary school biology teachers

FINDINGS

The following are some of the findings of the present study with respect to the aims, the subject matter and the methods of biology teaching:

1. Biology teachers in the secondary schools of Lebanon consider the following to be the most important aims of biology teaching:
 - a. Developing the right attitude toward the conservation of natural resources.
 - b. Helping the students to learn and practise the principles of healthy living.
 - c. Imparting useful knowledge which may be applied in the daily lives of students.
 - d. Developing scientific attitudes.
 - e. Aiding pupils in understanding biological principles which are common to all living things.
2. In general, biology teachers in Anglo-Saxon type schools attach more importance to the needs of students in their daily lives than biology teachers in Latin type schools; and biology teachers in Latin type schools give more importance to the acquisition of scientific methods and attitudes than biology

teachers in Anglo-Saxon type schools.

3. There is a notable difference between the aims chosen by biology teachers and those reported by biology students. While the aim of transmitting to the student "a body of factual knowledge" is considered relatively unimportant by the biology teachers as a whole, it is by far the outstanding aim of the majority of biology students. Most of the biology students have not been made aware of the real value of a course in biology.
4. In general, biology teachers consider the mental maturity, the interests and the needs of the learner as important criteria for the selection of subject matter of biology.
5. Biology teachers in Anglo-Saxon type schools pay relatively more attention to the direct usefulness of subject matter, while teachers in Latin type schools ascribe relatively more importance to the value of subject matter in teaching scientific methods and attitudes.
6. Biology teachers in Anglo-Saxon type schools consider sex education an important unit to be taught, but teachers in Latin type schools prefer not to teach it.
7. A variety of biology textbooks is being used in the secondary schools of Lebanon. In general, biology teachers are dissatisfied with the available textbooks. A good biology textbook especially written for Lebanon appears to be a real need.
8. The grade level of biology instruction varies widely in the secondary schools of Lebanon. In general the tendency is to

offer biology in the fourth secondary year in order to teach chemistry and physics in the fifth and sixth years.

9. Several different teaching methods are practised in biology classes. The most common methods used are the recitation and the lecture; and the methods least used are the socialized method and the laboratory method.
10. Biology teachers in Anglo-Saxon type schools use the lecture method more often than biology teachers in Latin type schools, and biology teachers in Latin type schools use the laboratory method more often than teachers in Anglo-Saxon type schools.
11. On the whole, the teaching procedures in the biology classes tend to be poor, especially with respect to (a) a fair allocation of questions to individual students and (b) the method of conducting the lesson.
12. In general biology teachers do not engage in activities such as taking students on field trips, taking students to medical schools, giving projects to students, having science clubs, etc. The very few biology teachers who consider such activities beneficial are mostly from Latin type schools.
13. The majority of the secondary schools of Lebanon do not have a biology laboratory or biology laboratory equipment.
14. Most of the schools do not have audio-visual apparatus and materials, such as opaque projectors, film and filmstrip projectors, models, charts, diagrams, etc.

15. Most of the secondary schools do not offer dissection or demonstration of specimens in their biology classes.
16. Biology students are particularly interested in the following activities concerned with biology teaching:
 - a. Watching biological films
 - b. Doing experiments with organisms
 - c. Going on biological field trips
 - d. Preparing models of the organs of organisms
 - e. Having science clubs
 - f. Working on biology projects
17. The majority of the biology teachers in the secondary schools of Lebanon have not more than five years of teaching experience. Most of them have B.A. or higher degrees. Only a few of them are professionally trained as teachers.
18. Various methods of evaluation are used to measure the progress of biology students. In the majority of cases, the primary aim of evaluation is the exposition of the extent to which the students have learned the subject matter of biology. Questions intended to reveal the development of scientific methods and attitudes in students are not used.

CONCLUSION

For the improvement of biology teaching in the secondary schools of Lebanon the following recommendations are offered:

1. The aims of biology teaching should be:

Primary Aims

- a. To develop the ability of students to meet effectively the biological needs of life.
- b. To develop the ability of students to apply scientific methods and to acquire the attitudes of scientists.

Secondary Aims

- a. To develop the interests of students.
- b. To develop appreciations.
- c. To develop desirable social attitudes.

Associate Aims

- a. To impart a body of factual knowledge about organisms.
- b. To provide students with skills.

2. General science in the first three classes of secondary education should be centered on biology. In the absence of such a unified program, at least one-third of the science syllabus in the first three classes of secondary education should be biology. In the last three secondary classes, biology should be taught in the fourth and sixth years. All of the fourth year science and part of the sixth year science syllabus should be biology.

3. The biology syllabus should be based on the life functions of organisms, in the following order:

First year: Introduction to life functions.
 Second year: Hygiene of life functions.
 Third year: Life functions in various organisms.
 Fourth year: Life functions in the human body.
 Sixth year: Advanced biology.

Sixth year program should be of two types, one for girls and the other for boys, Graduating girls should have as much as possible of the knowledge necessary for effective home-making.

4. Biology teachers should practise a greater variety of methods. Demonstration and individual laboratory work should be an integral part of the program in the following order:

First year: Teacher demonstration
 Second year: Student demonstration
 Third year: Student demonstration
 Fourth year: Individual laboratory
 Sixth year: Individual laboratory in the form of projects.

5. Because a good biology textbook especially written for Lebanon is not available, biology classes should have reference books. However, if the existing textbooks are to be used, the following are suggested:

First year: A Junior Course in Hygiene - J.H. Crawford
 Second year: A Senior Course in Hygien - J.J. Stooke
 Third year: Biology, A Textbook for First Examinations - H.J. Cooke, et al.

Fourth year: Human Physiology - L. Tokay

Sixth year: Selected references.

6. Laboratory instruction should limit the number of experiments which aim at verification and description. Rather it should be of a type which will evoke creative thought and discovery. For the reason a laboratory period which precedes the lecture period will give the most effective results in training students in scientific methods, and skills.
7. To evaluate the progress of students, a greater variety of methods should be used. Oral testing should be practised sparingly; objective tests and essay questions should include items to reveal changes in the attitudes and thinking processes of students.
8. Biology teachers should be well-trained both in their subject matter and in education. They should have taken at least a one-semester course in each of the following; general zoology and botany; human physiology and pathology; hygiene; genetics; evolution; techniques of slide preparation; psychology of education; philosophy of education; general science teaching; biology teaching; audio-visual methods and materials; general chemistry; physics.
9. The principles given in Chapter IX of this study for the effective application of the various methods should be examined and tried by biology teachers.
10. The Lebanese Baccalaureat Program should be reexamined and modified. The American University of Beirut should prepare a special syllabus

in Biology for secondary schools, and it should help to determine the content and evaluation of the biology courses in the secondary schools.

11. Both the Education and Biology Departments at A.U.B. should cooperate in training biology teachers. The Education Department should have either a well-equipped laboratory for teacher-training students, or it should use one of the laboratories of the Biology Department. The Biology Department should offer a course in "Hygiene and Pathology of School Children".
12. A "Secondary School Biology (or Science) Teachers' Association" should be organized. Preferably, the Education Department at A.U.B. should undertake its creation and functioning. The main job of the Association should be:
 - a. To prepare a biology textbook for secondary schools.
 - b. To publish a biology magazine for biology teachers and students.
 - c. To prepare an Arabic-English dictionary for biological terms.
 - d. To improve the teaching of biology in the secondary schools of Lebanon.
 - e. To encourage talented young students to be biologists in the future.
 - f. To operate an audio-visual center serving Lebanese secondary schools.

APPENDIX

APPENDIX A

1. The Questionnaire Submitted to Biology Teachers.
2. The Questionnaire Submitted to Freshman and Sophomore Students at the American University of Beirut.
3. The Questionnaire Submitted to Biology Students in the Secondary Schools of Lebanon.
4. The Observation Check List Followed During the Visits to Various Secondary Schools.

1. The Questionnaire Submitted to Biology Teachers

To the Respondent:

An attempt is made to prepare a thesis on "The Teaching of Biology in the Secondary Schools of Lebanon". To treat of the topic properly we have prepared this questionnaire to understand the existing status of the theme.

Will you kindly answer each item of the questionnaire as objectively as possible.

Please DO NOT write either your name or the name of your school on the questionnaire. We are interested in the schools of Lebanon as a whole and NOT in a particular school or teacher.

Thank you for your cooperation.

PART I

Please fill in the blanks.

1. How many students have you in your biology class? _____
2. How many of them are boys? _____
3. How many years of teaching experience have you? _____
4. Are you a full or a part-time teacher? _____
5. Please write in the space provided: a) The names of all the courses you are teaching, b) The grade level of each course, c) The number of periods you are teaching each course per week.

<u>Name of the courses</u>	<u>Grade Level</u>	<u>Number per week</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

REMARKS: Please state your remarks (if any) on Part I of the questionnaire.
(Space left)

PART II

The following are supposed to be the aims of Biology Teaching in the Secondary Schools. Each statement is preceded by eleven numbers, the first being zero. Express your opinion about the importance of each statement by encircling one of the numbers. The degree of importance increases from 1 to 10. That is, number 1 represents the least important, number 2 is more important, 3 still more, up to 10, which represents the most important. Encircle zero if you think that statement must not be considered as an aim in Biology Teaching.

In the Secondary Schools of Lebanon Biology must be taught;

- a) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To impart a body of factual knowledge about organisms.
- b) 0. 1. 2. 3. 4. 5. 6. 7. 9. 10. To aid pupils in acquiring biological principles which are common to all living things.
- c) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To help students in acquiring methods of investigation for gaining more information in the biological sciences.
- d) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To impart useful knowledge which might be applied in the daily lives of the students.
- e) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To train the students in technical skills. Such as dissecting animals, setting apparatus, collecting and preserving animals, etc.
- f) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To prepare the students for good family life.

- g) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To give a good background to the students to ensure their success in university entrance exams or in university courses or to pass official examination (baccalaureat).
- h) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop an interest for a vocation in biology.
- i) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To reveal the wonders of Divine Creation whereby the students can appreciate the existence of a Creator - God.
- j) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop the ability of the students in drawing.
- k) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop the ability of the students in note-taking.
- l) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop the right attitude toward conservation of natural resources.
- m) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To help the students learn and practise the principle of healthy living.
- n) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop the scientific method. That is how to observe, experiment, collect data, correlate the data, generalize and apply.
- o) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop avocational interests in order that leisure time may be used wisely. Such as collection of fossils.
- p) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To teach appreciation. To appreciate nature, biological research, beauty in nature, etc.
- q) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop the problem-solving ability of the student.
- r) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop scientific attitudes. Such as precision, suspended judgment, inquisitiveness, intellectual honesty.

- s) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop the creative ability of the student.
- t) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop good habits. Such as neatness organization, etc.
- u) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To develop socially desirable attitudes. Such as cooperation, responsibility, etc.
- v) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. To teach and inculcate in the student love and kindness toward organisms.
- w) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The above mentioned aims are desirable but I teach as a profession to earn my living.

REMARKS: Please state your remarks (if any) on PART II of the questionnaire.

(Space left)

PART III - Section A

The following are supposed to be some of the criteria for the selection of subject matter in Biology for Secondary Schools.

Please express your opinion on the importance of each criterion. The degree of importance increases from 1 to 10. Encircle zero if you think that statement must not be considered as a criterion to select subject matter.

- a) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The inherent value of the subject matter itself, by virtue of being any part of the biological sciences.
- b) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The adaptability of the subject matter to the learner's stage of mental maturity.

- c) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The adaptability of the subject matter to the interests of the students.
- d) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The imposed requirements of the government or higher institutions.
- e) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The usefulness of the subject matter in the lives of the students.
- f) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The value of the subject matter to teach the scientific method.
- g) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The bearing of the location of the school.
- h) 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. The value of the material in fulfilling the aims of biology teaching.

SECTION B

The following are some units of subject matter in Biology. In the space provided for each unit, put one of the following letters:

"a" if you consider that unit very important.

"b" if you do not consider it particularly important.

"c" if you consider it unimportant.

"d" if you do not teach it but you think it should be taught.

- a) ____ Taxonomy of the organisms. The study of the names of various phyla and classes of organisms.
- b) ____ The study of at least one representative organism from each phylum.
- c) ____ The study of heredity.
- d) ____ The techniques of agriculture and husbandry.

- e) ___ The study of evolution.
- f) ___ The study of sex education.
- g) ___ The study of first aids.
- h) ___ The study of diseases.
- i) ___ The study of the rules of healthy living.
- j) ___ The study of the physiological functions of the plants.
- k) ___ The study of the physiological functions of the human being.

SECTION C

1. Please evaluate the biology textbooks used in your school in terms of the following criteria. In the space provided put the letter of one of the following expressions:

"a" - Very poor

"c" - Satisfactory

"b" - Poor

"d" - Good

"e" - Excellent.

- ✓ a) ___ The subject matter content of the textbook.
- ✓ b) ___ The organization of the subject matter.
- c) ___ The reliability of the factual content.
- ✓ d) ___ The clarity, accuracy and attractiveness of the pictures.
- e) ___ The texture of the textbook.
- f) ___ The cost of the textbook.
- g) ___ The compatibility of the style to class level.
- ✓ h) ___ The exercises, problems and projects of the textbook.
- ✓ i) ___ The up-to-date presentation of the biological information.

2. Please enumerate other advantages or limitations (if any) the text-book you use has. _____
- _____

3. Please write in full the names of the biology textbooks you use.

Please write the name of the biology manual (if any) you use.

4. Please write the number of the chapters and pages you omit from the text.

<u>Chapter</u>	<u>Page</u>	<u>Name of textbook</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

5. Please write the main topics of subject matter not found in your textbook but which you are preparing for the class from other sources.

6. In the space provided write one of the following: "always", "Often", "Usually", "Sometimes", "Never".

_____ I give the same assignment to all the students.

REMARKS: Please state your remarks (if any) on PART III.

(Space left)

PART IV

The following is a list of courses above High School level followed by four blank columns. For each course please put a check mark (✓). Put the check in the first column if you have not taken that course. Put the check in the second column if you have taken that course but you think you need more training in that course as a biology teacher. Put the check in the third column if you think that your training in that course has been more than necessary. Put the check in the last column if you think your training in that course has been neither more nor less than your need.

<u>Name of Course</u>	<u>Not Taken</u>	<u>Need More</u>	<u>Need Less</u>	<u>Same as obtained</u>
General Biology	—	—	—	—
General Zoology	—	—	—	—
General Botany	—	—	—	—
Anatomy	—	—	—	—
Embryology	—	—	—	—
Physiology	—	—	—	—
Genetics	—	—	—	—
Evolution	—	—	—	—
Entomology	—	—	—	—
Bacteriology	—	—	—	—
Biochemistry	—	—	—	—
Psychology of Education	—	—	—	—
Philosophy of Education	—	—	—	—

<u>Name of Course</u>	<u>Not Taken</u>	<u>Need More</u>	<u>Need Less</u>	<u>Same as obtained</u>
Practice Teaching	—	—	—	—
Science Teaching	—	—	—	—
Audio-Visual Education	—	—	—	—
General Psychology	—	—	—	—
Psychology of Adolescence	—	—	—	—
General Chemistry	—	—	—	—
General Physics	—	—	—	—

Please add to the list the names of the courses you have taken in Education and Biology not mentioned here. Treat them in the same way as you did the foregoing.

<u>Name of Course</u>	<u>Not Taken</u>	<u>Need More</u>	<u>Need Less</u>	<u>Same as obtained</u>
_____	—	—	—	—
_____	—	—	—	—
_____	—	—	—	—
_____	—	—	—	—
_____	—	—	—	—

Please write in the space provided: a) the qualifications you have obtained above High School level, b) the name of the school, c) the year of graduation.

<u>a) Degree or Certificate</u>	<u>b) Name of School</u>	<u>c) Year</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

REMARKS: Please state your remarks (if any) on PART IV.

(Space left)

PART V - Section A

The following are five different methods to teach Biology. For each method please put the letter of one of the following expressions.

- "e" - Exclusively. (If you apply only that method and no others).
 "q" - Often. (If you apply mostly that method and rarely other methods).
 "s" - Seldom. (If this is not your major method but you use it rarely).
 "n" - Never. (If you never practise this method).

- 1) _____ LECTURE (The material is given through lectures. Usually the students do not participate. A textbook might be used.)
- 2) _____ RECITATION (A textbook is adopted. On the request of the teacher the students recite their lessons every day, answering questions from the assigned pages).
3. _____ LABORATORY (The students spend most of their time in the laboratory examining animals or verifying laws. Lab manuals are considered primary, the textbook and recitations secondary).
- 4) _____ DEMONSTRATION (No laboratory experiment is carried by the individual student. The lessons are taught either by lectures or class discussions, both being enriched by demonstrations by the teacher or groups of students.
- 5) _____ SOCIALIZED METHOD (Units of work are distributed to groups of students in the form of reports, research, experiment or project, etc. The groups in turn conduct the class. Very few formal class discussions and recitations).

REMARKS: Please state your remarks (if any) on PART V, Section A.

(Space left)

Section B

Please answer the following, considering the Biology lesson till February 15th of the academic year of 1955-1956 (or its equivalent).

1. How many times has the class gone on a field trip? _____
2. How many times has the class seen films or filmstrips? _____
3. How many projects has each student carried alone or in groups? _____
4. How many charts, diagrams, models or other materials has each student prepared? _____
5. How many reports has each student written? _____
6. How many minutes of lab work has each student done per week individually? _____
7. How many minutes of lab work has each student done per week in groups of two or more? _____
8. How many times have you invited other persons to give a lecture or to perform a demonstration to your biology students? _____
9. How many times has the class gone to a medical school? _____
10. Is there a science club in your school? _____
11. Please put a check in front of the animals which the biology students examine in the laboratory during the whole academic year. Please add to the list any others you may have examined.

___ Protozoans	___ Ascaris	___ Starfish	___ Frog	___ dog
___ Sponges	___ Earthworm	___ Crayfish	___ Bird	___ Rabbit
___ Hydra	___ Clam	___ Grasshopper	___ Cat	___ Mouse
_____	_____	_____	_____	_____

PART VII

Please copy in the space provided the questions of the 1956 mid-year (or equivalent) examination in Biology.

(If you already have an additional copy you may attach it to the questionnaire instead of copying it on this sheet).

(Space left.

b. Freshman Arts.

d. Sophomore Arts.

e. Other. (Please state it) _____

6. What do you intend to study?

a. Engineering.

d. Agriculture.

b. Medicine.

e. A physical science(state)_____

c. Pharmacy.

f. A social science(state)_____

g. Other. (Please state it) _____

II. Please encircle the letters which describe the situation in your school.

a. The Secondary School I attended had a laboratory specially for
Biology.

b. It had a laboratory used for Biology and other sciences.

c. It had a laboratory for other sciences but not for Biology.

d. It had no laboratory for any sciences.

e. It had a regular laboratory period every week in Biology.

f. It had no regular lab. periods in Biology but had in other sciences.

g. It had no lab. periods but the teacher demonstrated experiments in
Biology.

h. It had neither lab. exercises nor demonstrations in Biology.

III. In your Secondary School in which classes have you taken the following?

a. Biology_____

b. Chemistry_____

c. Physics_____

IV. To what extent you think you are trained in the following points in
the Secondary School. In the provided space put one of the following
letters:

"a" - for very good.

"d" - for very poor.

"b" - for good.

"e" - for "I do not know".

"c" - for poor.

1. _____ In subject matter of Biology as a background to pass examinations.
2. _____ In technical skills. Such as dissecting animals.
3. _____ In the principles of healthy living.
4. _____ In scientific method and investigation.
5. _____ In an attitude towards the conservation of natural resources.
6. _____ In a knowledge of heredity.
7. & _____ In a knowledge of sex education.
8. _____ In a knowledge of evolution.
9. _____ In a knowledge of common diseases.

V. In the provided spaces please put the letter of one of the following:

"a" - I like it very much

"d" - I hate it.

"b" - I like it.

"e" - I am indifferent.

"c" - I did not like it.

(Please answer as a Biology student in your Secondary School)

1. _____ To do laboratory experiments.
2. _____ To do laboratory experiments individually not in groups.
3. _____ To carry projects as a laboratory exercise.
4. _____ To draw charts, diagrams, etc.
5. _____ To prepare models. Such as the heart.
6. _____ To watch a demonstration.
7. _____ To watch a film or a film strip.

8. _____ To have a science club.
9. _____ To have the lessons in the form of discussions.
10. _____ To have the lessons in the form of lectures.
11. _____ To have the lesson in the form of reading from the text in class.
12. _____ To write a report.
13. _____ To go on a field trip for educational purposes.
14. _____ To follow the textbook strictly.
15. _____ To have unexpected drop quizzes.
16. _____ To have announced quizzes often, at least once in a week.
17. _____ To use reference books.

VI. Please evaluate your Secondary School Biology teacher in terms of the points given below by putting one of the following letters in the provided spaces.

"a" - for very good.

"d" - for poor.

"b" - for good.

"e" - for very poor.

"c" - for average.

"e" - for very poor.

1. _____ His (her) knowledge of subject matter in biology.
2. _____ His (her) ability to explain the text.
3. _____ His (her) ability to perform experiments and demonstrations.
4. _____ His (her) ability to control the class.
5. _____ His (her) ability to evaluate the work of the students.
6. _____ His (her) ability to keep the class interested in the subject.
7. _____ His (her) eagerness to help the students.

VII. 1. If you were required to take only one of the following sciences in the secondary school; physics, chemistry, biology, which one would you choose? What would be your second choice? Please write the reason for your preference in the space provided.

(Space left)

2. Which of the three sciences you think is the most useful for students who do not continue their education beyond High School level? Please give the reason for your preference.

(Space left)

VIII. Please answer one of the following questions using the other side of this sheet. Answer the first question if you have not taken any courses in Biology after your Secondary Education (or Baccalaureat Part I). Answer the second question if you have taken one or more Biology courses after your Secondary Education (or Baccalaureat Part I).

1. If you were in the place of your Secondary School Biology teacher what changes would you introduce in the Secondary School Biology program? (In respect to laboratory, textbook, methods, quizzes and any other activity.
2. What difficulties did you meet in the Biology courses you took after your Secondary Education which you want to tell your Secondary School teacher so that he (she) may prepare students better for the university Biology courses?

3. The Questionnaire Submitted to Biology Students in the Secondary Schools of Lebanon.

Please DO NOT write your name

I. For each of the following statements please put a letter in the provided spaces.

Put the letter "a" if you like the statement very much.

Put the letter "b" if you like the statement.

Put the letter "c" if you do not like the statement.

Put the letter "d" if you hate the statement.

Put the letter "e" if you are indifferent, that is you neither like nor hate it.

1. ____ To draw the different parts of animals and plants.
2. ____ To do experiments with animals and plants.
3. ____ To watch a demonstration in the classroom.
4. ____ To watch a film about different aspects of biology.
5. ____ To go on a field trip to collect animals, plants etc.
6. ____ To prepare models of heart, kidney, liver, etc.
7. ____ To take lecture notes.
8. ____ To have unexpected drop quizzes.
9. ____ To have announced quizzes often, at least once in a week.
10. ____ To study the Biology lesson.
11. ____ To ask questions in the biology class.
12. ____ To have sex education.
13. ____ To get high marks.
14. ____ To continue the biology textbook which is being used now.
15. ____ To have more biology lessons than what we are having now.

II. Please answer the following questions on the other side of this sheet.

1. Why are you studying biology?
2. The person who has prepared these questions is a graduate student at the A.U.B. and at the same time a young biology teacher. What do you suggest for such a person to be a GOOD Biology Teacher?

4. The Observation Check List Followed during the Visits to Various
Secondary Schools.

Observation Sheet

I. Classroom:

Size

Light

Blackboard

Decoration

II. Class period:

Nature of method

Starting Point

Questioning

Ending point

Planning

III. Students:

Interest

Participation

Preparation

Particulars

IV. Laboratory:

Size:

Blackboard

No. of individual spaces

No. of sinks

Other equipment _____

Decoration _____

Library _____

VI. Questions to the Principal:

What percent of the class continue their education?

What syllabus is followed?

What is the role of the teacher in planning the course?

VII. General Remarks

APPENDIX B

The Letters Sent to Secondary Schools.

1. The letter sent by the Education Department of the American University of Beirut to the principals of secondary schools.
2. The letter sent by the investigator to the principals before the visit.
3. The first letter sent to principals by the investigator after the visit.
4. The second letter sent to principals by the investigator after the visit.

1. The Letter Sent by the Education Department of the American University of Beirut to the principals of Secondary Schools.

April 5th, 1956

Dear Sir:

This is to recommend to your kind attention Mr. Yeghia Babikian, a graduate student of the Education Department at this University, who is writing his M.A. thesis on a study of the teaching of general biology in Lebanese schools. In order to accomplish this task, Mr. Babikian will need to visit classes in Biology in various schools and discuss the subject with the teachers of biology. I shall be very grateful if you will kindly facilitate Mr. Babikian's visits to your school and arrange for him to interview teachers concerned. The results of his study will be made available to you and to your teachers. Because of Mr. Babikian's special ability and preparation, I feel confident that in the end the results of his study will be beneficial to the teachers.

Your cooperation in this matter will be deeply appreciated.

Sincerely yours,

Habib A. Kurani
Chairman, Department of Ed.
American University of Beirut

2. The Letter Sent to Principals by the Investigator before the Visits.

Dear Principal:

Will you kindly take this letter into consideration.

I am writing an M.A. thesis on "The Teaching of Biology in the Secondary Schools of Lebanon". I would like to have the help of your biology teacher by visiting your school. In this respect Dr. H. Kurani, the Chairman of Education Department at A.U.B., has written a recommendation to present to you when I visit your school.

Will you kindly fill in the sheet found in the enclosed envelope and send it to me as soon as possible.

Thankfully yours,

Yeghia Babikian

(Enclosed)

Yeghia Babikian:

Our Biology lessons are on the following hours:

	<u>Monday</u>	<u>Tuesday</u>	<u>Wednesday</u>	<u>Thursday</u>	<u>Friday</u>	<u>Saturday</u>
Time:	_____	_____	_____	_____	_____	_____

Our Biology teacher can speak fairly well the following

languages:

_____, _____, _____, _____.

I have the following remarks:

Principal

3. The First Letter Sent to Principals by the Investigator after the Visits.

May 19, 1956

Dear Principal:

Thank you for your cooperation when I visited your school. I found your Biology teacher active and willing to help.

May I inform you that I have left a questionnaire with the Biology teacher to be filled out which, I hope, has already been prepared. In case he has forgotten to send it back to me (since I have not received it yet), will you kindly remind him that I shall greatly appreciate receipt of it in several days.

I like to reassure you again that the investigation will evaluate the Secondary Schools of Lebanon as a whole and not a particular school or teacher.

I hope that the results will be available to you and to your Biology teacher.

Thankfully yours,

Yeghia Babikian

4. The Second Letter Sent to Principals by the Investigator after the Visits.

June 5, 1956

Dear Principal:

May I ask your favourable consideration the questionnaire you received recently on the teaching of Biology in the Secondary Schools? I am sure your Biology teacher appreciated its importance and prepared it, but since I have not received it yet, it seems he has forgotten to send it back.

Will you kindly remind him that I will greatly appreciate receipt of it in several days?

I like to reassure you again that the investigation will evaluate the Secondary Schools of Lebanon as a whole and NOT a particular school or teacher.

I hope that the results will be available to you.

Thankfully yours,

Yeghia Babikian

APPENDIX C

Secondary School Biology Requirements of Various Institutions:

1. The American University of Beirut.
2. The General Certificate Examination.
3. The Lebanese Baccalaureat Program.

1. The Biology Requirements of the American University of Beirut.¹

"Biology. Based on a year's work in zoology, botany, or general biology including experience with animals or plants themselves."

¹ The American University of Beirut, Information for 1956-7, p. 17.

2. Biology Requirements of the General Certificate Examinations.¹PART I

The characters of living organisms; differences between higher animals, micro-organisms and higher plants as illustrated by a mammal and especially man, yeast and bacteria, and a flowering plant respectively.

Protoplasm, nucleus, and cytoplasm illustrated by amoeba and plant cells. Elementary facts about the composition of protoplasm, proteins, carbohydrates, fats, salts. Cell multiplication. Growth.

Conditions necessary for life. Sterilization by chemical action. Effect of temperature on the activity of yeast. Biological effects of high and low temperatures including their application in refrigeration and sterilization by high temperatures.

Nutrition. The three main types exemplified by a flowering plant, Mucor and man. The constituents of an adequate human diet. The interdependence of the nutrition of all organisms illustrated by food chains, the carbon and nitrogen cycles in nature (without names of specific bacteria). The part played by enzymes in digestion and synthesis.

Respiration. Essentials of respiration in flowering plant and mammal.

Movement. Locomotion of animals, and tropisms of plants. The skeleton of a mammal in general outline. Simple examples of muscle action including illustration of leverage.

1 Oxford and Cambridge Schools Examination Board, Regulations for Certificate Examinations for the Year 1957, pp. 98-99.

Nervous co-ordination. An elementary account of the sense organs. Initiation of action by the sense organs and nervous system. Elementary account of the reflex arc.

Reproduction. Asexual (Amoeba, Mucor), vegetative (potato), and sexual methods (flowering plant and vertebrate). The significance of the different methods. Reproduction of frog and mammal to show essentials of fertilization and parental care.

PART II

Micro-organisms. Yeast. Amoeba and bacteria as example of life without differentiation of cells.

Flowering plants. Structure and functions of the parts of the flowering plant; morphology throughout the year of a deciduous tree and a herbaceous plant. Knowledge of minute anatomical detail sufficient only to enable candidates to understand the physiological significance of the plant organs will be required. Photosynthesis studied experimentally by starch formation and oxygen production. Perennation; storage of food, food reserves and storage organs. Vegetative reproduction by rhizomes, tubers, and bulbs. Seeds, their structure and germination, illustrated by a broad bean. Transpiration. The root system and water uptake. Quantitative experiments on the uptake of water. Soil and its mode of formation. The structure of the flower. Differences between wind and insect pollinated flowers. Two examples of the latter (e.g. buttercup and deadnettle) studied with the aid of a hand lens so as to relate structure to pollination and fruit and seed formation.

A mammal. The general macroscopic structure and elementary physiology. Outlines of mammalian anatomy and position of main organs in the body. Teeth, their relation to function and diet. Digestion, parts of the alimentary canal and their functions; experiments illustrative of enzyme action. Respiration, including experiments on the intake of oxygen and the production of carbon dioxide. Excretion. Composition and functions of the blood. A simple account of the circulation and of the action of the heart, deductions from simple vascular changes (blushing, fainting, and sweating), valves in the veins. Temperature control. Hormone action with one example only. Defence against infection, and the nature of pus.

Insects. Outlines of the external structure, life cycle, food and habits of the cockroach, butterfly, bee, mosquito, and house fly. Details of the mouth parts will not be required.

Natural History. The candidates will be expected to show knowledge from personal observation in the field of some of the commoner animals and plants of the British Isles; also of the animals and plants of any one suitable habitat from the point of view of the interrelations of the species found there and their adaptations to the conditions of their environment. The life histories and habits of at least five animals (other than the insects mentioned in the last section) and five plants should be known. The questions on this section will be such as can be answered by those living in cities, but will require that the candidates shall have actually made observations out of doors.

3. Lebanese Baccalaureat Program. Syllabus in Natural Sciences.¹First year:

Detailed study of:

1. Man. The human body, skeleton, muscles, nutrition, circulation, respiration, nervous system, the senses.
2. Animals. Carnivorous animals, herbivorous, mammals, birds, reptiles, batrachians, (amphibians) fishes, articulates, worms, molluscs, zoophytes.
3. Vegetables. General characteristics of plants, roots, stems, leaves, flowers. fruits, grain. Classification of plants. Mushrooms, bacteria. Useful plants and harmful plants.
4. Geology. Eruptive rocks (volcanic) crystalline, sedimentary, (lime stone, siliceous, clay, saline and organic).

Second year:

A. Botany. Classification of vegetables.

1. The thallophites, mushrooms, algae, lichens.
2. Mosses, vuscular cryptogams, phonerogams.
3. A study of a flowering plant.
 - (a) roots, stem and leaves
 - (b) the flower
 - (c) the fruit and the seed
4. Gymnosperms, coniferous plants.
5. Antiosperms. Monocotyledons, graminaceae, palm trees, liliaceous plants.

1 Ministry of National Education and Fine Arts, Program of Studies, A translation from the original Arabic by Point IV, Department of Education, A.U.B.

6. Dicotyledons, apetalous, amentaceous.

Dicotyledons gamopetalous, solanaceous, labiate, cucurbitaceous

Dicotyledons-dialypetaceous, ranunculaceous, rose family,

leguminous, crudiferous, ombelliferous.

B. Zoology. Main division of the animal kingdom:

1. Nonsymmetrical animals. Protozoa, spongiae.

2. Radially symmetrical animals. Coelenterates, echinoderms.

3. Bilaterally symmetrical animals

a. worms

b. arthropodes, crustaceans, arachnoids, myriopods, insects.

c. molluscs

d. vertebrates

1. cold-blooded vertebrates or variable temperature

fishes batraceans, reptiles.

2. Vertebrates of constant temperature, birds-mammals.

Third year:

A. Hygiene.

1. Notions about human physiology and anatomy.

2. Notions about microbiology, microbes, animal microbes.

3. Spontaneous generation and experiments of Pasteur.

4. Fermentation - alcoholic, acetic, lactic, butyric.

5. Infection by microbes: contagious diseases, protection from contagious diseases, sterilization and disinfection. Combatting flies.

6. Food. Principal food materials for man, food from vegetable origin, food from animal origin, preserved food, meals.

Accidents resulting from food, parasites transmitted by meat.

Poisoning by food.

7. Water. Potable water, contaminated, water, purification of water.
 8. Alcoholic drinks. Fermented drinks, food value of fermented drinks, distilled drinks, poisonous effects of alcohol, alcoholism, aromatic drinks.
 9. Air. The air we breathe, asphyxia, treatment of a case of asphyxia, dust in the air.
 10. Physical exercise. Its hygienic effects. Effects on beauty of body, defects of physical exercises and their abuse, physical culture.
 11. Bodily cleanliness. General cleanliness, clean clothes.
 12. Habitation. House, management of, ventilation, heating, lighting, keeping dirt away from it.
- B. Geology.
1. Volcanic rocks and crystalline rocks.
 2. Sedimentary rocks. lime stones, siliceous rocks, argillaceous rocks, salt rocks, organic rocks.
 3. Action of air.
 4. Snow and glaciers.
 5. Action of rain water.
 - Evaporation water.
 - Infiltration water.
 - Running water.
 6. Action of sea water and living things.
 7. Soil movement. Earthquakes, slow movement of soil.

8. Volcanoes and the volcanic phenomena. Study of geological periods, stratigraphy and paleontology relative age of rocks.

The Primitive Eras

Primary Era:	The primary living world The primary physical world
Secondary Era:	The secondary living world The secondary physical world
Tertiary Era:	Tertiary living world Tertiary physical world
Quaternary Era:	Quaternary living world Quaternary physical world

- C. Applied Geology. Application of geological information on mining, public works, agriculture, and hygiene.

Fourth year:

A. Animal anatomy and physiology.

1. Anatomy of the digestive system. The alimentary canal, dentition in man; digestive glands; in different animals.
2. Digestion and absorption. Foods, transformation of foods--absorption in the intestine.
3. Circulation of the blood. The blood--the circulatory system, physiology of blood circulation, the lymph in different animals.
4. Secretion and excretion. The glands, the kidneys, sweat glands.
5. Assimilation. Animal heat, a meal.
6. The skeleton and the muscles.
7. The bones and the joints. The skeleton and the muscles. Different in different animals.

8. The nervous system. The nervous elements, anatomy of the nervous system physiology of the nerve centers.
 9. The sense organs. Sight, touch, taste, smell, hearing.
- B. Plant anatomy and physiology.
1. The roots. Characteristics, structure, functions.
 2. The stem. Characteristics, structure, functions.
 3. The leaf. Characteristics, structure, functions.
 4. The three major functions of nutrition. Nutrition of plants with chlorophyl. Nutrition of plants without chlorophyl, food reservation.
 5. Nutrition and nutrition reservation. Respiration, chlorophyl, assimilation transportation.
 6. Reproduction in plants.
 7. The flower. General notions about flowers. Flower covering, functions of flowers, uses of flowers.
 8. Fruits and seeds. Uses of fruits and seeds. Evolution of plants through culture.

APPENDIX D

Examination Papers in Biology

1. Biology Examinations for Entrance to the Freshman class of the American University of Beirut.
2. Biology Examinations of General Certificate Examinations-- Ordinary level.
3. Biology First Term Examinations in various secondary schools of Lebanon in the academic year 1955-56.

1. Biology Examinations for Entrance to the Freshman Class of the American University of Beirut.

a. The test of October, 1951.

1. Name five harmful insects, the harm they do, and the means of getting rid of them.
2. Is the green color of plants useful or harmful? Does the plant benefit from it? When and how?
3. Name an animal's life history. To what large group of animals (phylum) does it belong?
4. Distinguish between: (a) Digestion and assimilation, (b) living and non-living matter, (c) bacteria and respiration, (d) decay and respiration, (e) absorption and secretion.
5. Describe any one of the following physiological processes: circulation; excretion; digestion.
6. Name the characteristics of either one of the following phyla: Arthropoda; Platyhelminthes.

b. The test of October, 1952.

Instructions: Answer any seven questions.

1. Define life. In what ways are living and non-living things similar?
2. Who were the following men and what did each of them do?
a. Charles Darwin, b. Louis Pasteur, c. Gregor Mendel, d. Linnaeus, e. Lamarck.
3. Identify the following parts of a cell and give the function of each: a. nucleus, b. cytoplasm, c. plasma membrane.

4. Name five animal phyla and give the principal characteristics of each.
 5. Name the principal vegetative parts of a flowering plant and give the function of each part.
 6. Name five harmful insects found in the Near East, and tell why they are harmful.
 7. What is photosynthesis? Could men live without it? Write a chemical equation showing this process.
 8. Is the determination of sex due to the chromosome composition of the egg, the sperm, or both?
- c. The test of October, 1953.
1. Draw and label neatly a typical animal cell.
 2. Give the functions of each of the following: a. green leaf, b. root, c. kidney, d. lung, e. seed.
 3. Place the number of the correct phylum before the name of the animal which belongs to it:

Sample:

<u> x </u> dog	x chordata
<u> </u> amoeba	1 protozoa
<u> </u> crayfish	2 porifera
<u> </u> earthworm	3 coelenterata
<u> </u> man	4 platyhelminthes
<u> </u> planaria	5 nemathelminthes
<u> </u> hydra	6 annelida
<u> </u> starfish	7 mollusca
<u> </u> clam	8 echinodermata
<u> </u> frog	9 arthropoda
<u> </u> grasshopper	10 mollusca

- ___ liver fluke
- ___ sponge
- ___ paramecium
- ___ tapeworm
- ___ snail

4. Name the parts of a typical flower and give the functions of each part.
 5. Define: (a) chlorophyll, (b) plasmolysis, (c) assimilation, (d) mitosis, (e) digestion.
 6. Give the contributions of any 5 of the following men to biology:
 - (a) Linnaeus (b) Darwin (c) Lamarck (d) Mendel
 - (e) Harvey (f) Pasteur (g) Aristotle(h) Hooke
 - (i) De Voies (j) Leeuwenhock.
- d. The test of October, 1954.
1. Name ten animal phyla and give one representative of each.
 2. Name five insects which (a) are beneficial to man, (b) spread disease germs, (c) are injurious to plants.
 3. Draw and label neatly of a typical plant cell.
 4. Describe the digestive system of any animal you know well.
 5. What are the functions of roots and stems?
 6. What is meant by the following: photosynthesis; hemoglobin; dicotyledon; parasite; bacteria; xylem; midrib; pistil; respiration; and zygote?

e. The test of October 1955.

1. Draw and label neatly a cell of amoeba or any other protozoan.
2. What are the functions of leaves and stems?
3. What is meant by each of the following: digestion, stamen, leaf veins, epidermis, liver, fertilization, arthropod, ovary, parasite, plasma?
4. Name six harmful animals to man, each belonging to a different phylum and give the phylum and the harm done by each animal mentioned.
5. Describe the reproductive system of any invertebrate that you know best.
6. Discuss one of the following: 1. Interdependence of plants and animals, 2. complete metamorphosis of an insect, 3. adaptation.

2. General Certificate Examinations in Biology.

a. The test of July, 1952.

Answer five questions and not more. Credit will be given for concise answers which keep to the point. Give diagrams if they would make the text of an answer more easily understood.

1. Animals and plants contain compounds of nitrogen. In what form is the nitrogen when it is taken into (a) animals, and (b) plants? To what use are these nitrogen compounds put by animals and plants?
2. A pair of thrushes may lay 5 eggs twice a year, and the same thrushes may live for 5 years. In view of these facts, explain how it is that the number of thrushes, and other animals, in the world remains more or less constant.
3. Describe in detail experiments which you have carried out to demonstrate:
 - (a) That green leaves form starch in daylight.
 - (b) That green leaves give out oxygen in daylight.
 - (c) That green leaves give out carbon dioxide in the dark.
4. What do you mean by excretion? Describe the excretory organs of a mammal.
5. With the aid of labelled diagrams of named plants describe three different methods of vegetative reproduction.
6. Describe the life cycle of one kind of butterfly, giving its name, and mentioning how it spends the winter. How may a butterfly be preserved after it is caught?

7. Make a diagram of the female reproductive system of a mammal, without labelling. By putting letters on the diagram show (a) the usual place of liberation of the male cells, (b) the place of fusion of male and female germ cells, (c) the place where the embryo is housed.

How does the young mammal obtain food before, and shortly after birth?

8. In what ways do the flowers of plants which are pollinated by insects differ from those which are pollinated by the wind? Illustrate your answer with one example of each.

b. The test of July, 1953

Candidates must answer Question 1 and four others. Credit will be given for concise answers which keep to the point. Give diagrams if they would make the text of an answer more easily understood.

1. Make labelled diagrams to illustrate the differences between specimens E and F.

What explanation can you suggest to account for these differences?

2. Describe the mode of life of two carnivorous and two herbivorous animals which you have observed in their natural surroundings. Your answer should not include domestic or farm animals.
3. Describe the teeth of two different animals and discuss how their structure is related to the diet of the animals.
4. Give the name of one cultivated plant in each of the following categories: (a) an annual; (b) a perennial herb; (c) a biennial; (d) a tree or shrub.

In each case give a short description of that part of the plant which is used by man.

5. Describe the nervous system of a named mammal. What are the functions of the nervous system you describe?
6. Describe how water from the soil reaches the leaf of a tree. State what happens to this water after it has reached the leaf.
7. Give an account of the life-history of the mosquito and of the house-fly. In what way do these insects affect the life of man?
8. Describe the structure of a named seed. What experiments could you perform to find out the conditions necessary for it to germinate?

c. The test of July, 1954.

Candidates must answer Question 1 and four others. Credit will be given for concise answers which keep to the point. Give diagrams if they would make the text of an answer more easily understood.

1. Draw specimen Y and with the aid of a simple diagram indicate its position in the animal.
Mention two important functions of this bone.
2. Explain the importance of pollination. Describe carefully how you would attempt to discover whether a named plant is usually self-pollinated or cross-pollinated.
3. What constitutes a good garden soil? Explain how the composition and texture of the soil may be affected by the organisms living in it.

4. Describe the main functions of the blood in a mammal. How do small animals such as Amoeba manage without a blood system?
5. Describe the methods by which the human body is able to resist infection.
6. Give an account of the structure and functions of the stem of a named annual plant.
7. Describe the workings of the kidney in a mammal. What other methods of excretion are found in mammals?
8. Give an account of the changes which you yourself have noticed in the appearance or habits of any one plant and any one animal during a year of its life.

Do not choose the broad bean, the butterfly, the house-fly or the mosquito.

d. The test of July, 1955.

Candidates must answer Question 1 and four others. Credit will be given for concise answers which keep to the point. Give diagrams if they would make the text of an answer more easily understood.

1. Give the meaning of four of the following terms: cotyledon, bulb, zygote, spore, vitamin, pus.
2. Make a large labelled diagram of a transverse section of a leaf. What gases pass into the leaf, and out of it, in (a) sunlight, (b) darkness?
3. Give an illustrated account of the life history of (a) an insect with an aquatic larva, and (b) an insect with a terrestrial larva.

4. Describe the processes of digestion of a piece of lean meat by a mammal. What is the subsequent fate of the products of this digestion?
5. Contrast the action of nerves and hormones in the coordination of the animal body.
6. What are the functions of plant roots?
How would you measure the rate of water uptake by the roots of a plant?
7. What are the principal substances found as reserve foods in seeds?
What happens to these substances when growth begins, and how are these changes brought about?
8. Write an account of any biological work in the field that you have carried out either on your own or with a biology class.

3. Biology First Term Examinations in various secondary schools of Lebanon in the academic year 1955-6.

A. Latin Type Schools - (translated from French)

School a -

1. The anatomy of the eye.
2. The abnormalities of the eye.

School b -

1. Reproduction in mushroom.
2. Structure and reproduction of spirogyra.

School c -

1. The description of the digestive track.
2. The description of the middle ear and the mechanism of hearing.
3. Diagram of the skin of the palm. The physiology of the sense of touch.

School d -

1. The structure of a bone. The growth of bones.
2. The diagram of the eye.

School e -

1. Normal and abnormal vision.
2. The anatomy of the physiology of sympathetic and parasympathetic nervous systems.
3. The structure of the function of the small intestine.
4. The chromosomes during the process of mitosis and meiosis, their role in transmission of characteristics.
5. The functions of the pancreas.

B. Anglo-Saxon Type Schools.

School a.

1. Why do men and animals need food? What are the necessary food-stuffs?
2. What is a balanced meal? What would you consider a balanced meal for supper?
3. What are the different stages of digestion in man?
4. What happens to the digested food?
5. How do plants get their food? How do plants take in minerals and what is the use of these minerals in plants?
6. Why do men and animals breathe? Why do we breathe faster when we run or do hard work?

Answer any five of the above questions.

School b -

1. a. Draw and label neatly an animal cell.
- b. Give the main differences between plants and animal cells.
2. a. Give the scientific names for each of the following: cat, dog, horse, house-fly, and dandelion.
- b. Define any five terms:
 1. division of labor
 2. Homologous structures
 3. Protoplasm
 4. Protozoans
 5. Chlorophyl
 6. Linnaen System of classification.

School c -

1. With a careful drawing describe the structure of a quill feather of a bird. Discuss carefully how the feathers in the wing are arranged so that the bird can move forward in the air.
2. Describe the development of the butterfly and describe the grown-up butterfly. Briefly give the differences between a butterfly and a moth.
3. Describe the parts of a flower such as the buttercup and discuss the work of a flower. What do you know about pollination and fertilization?
4. Write short notes on any six of the following:
 - (a) making bone, (b) ribs, (c) muscle, (d) gills, (e) movement in water, (f) joints, (g) migration, (h) backbone, (i) tadpole, (j) cartilage.

School d -

Part I

1. Make a drawing of a Paramecium and label all its parts.
2. Make a diagrammatic drawing of the alimentary Canal of an insect, label and describe briefly the functions of each part.
3. Make a drawing of a Hydra and Label the following parts. Foot, Hypostome, endoderm, ectoderm, enteron, mesoglia, tentacles.
4. Mention one very important human parasitic disease transmitted by mosquitoes. Describe how it is carried from person to person. Give the life cycle of the mosquito which carries it. Give two methods for exterminating mosquitoes.

Part II

Fill in the missing words. (Write on this sheet.)

1. The process by which a young insect changes into a mature insect after undergoing considerable change is called _____.
2. The body of an insect is divided into three regions. Namely,
 1. _____, 2. _____, 3. _____.
3. Respiration in insect is by a system of _____ which open out by paired _____ on the sides of abdomen.
4. The function of the blood in insects is _____.
5. The method of multiplication in bacteria is called _____.
6. Under unfavorable conditions bacteria produce resistant bodies called _____.
7. Spirogyra consists of a number of Cylindrical _____ joined end to end.
8. Bacteria cause diseases by producing harmful _____.
9. The body tries to defend itself against the attack of bacteria by the help of _____ and _____.
10. Fertilization in mosses and ferns requires the presence of _____ which carries the _____ to words the _____.
11. Chalk, limestone, and marble are called _____. They are formed by the _____ animals, being their accumulated _____.
12. Each cell of spirogyra has a cellulose _____, _____, _____, _____, filled with cell sap, and a spiral _____.

13. Amoebae which live in the bodies of animals consuming their tissues are called _____.
14. Movement is produced in the earthworm by bristles called _____ and _____.
15. The blood of the earthworm is red because of dissolved _____.
16. Knots of nerve cells forming nerve centers in earth worm are called _____.

School e -

1. Give fully illustrated accounts as a result of observation you have made on the following:
 - a) Structure of a dicotyledon stem.
 - b) Structure of a dicotyledon root.
 - c) Locomotion in a fish.
 - d) Locomotion in a frog.
 - e) Classes of food reserve found in plants.
2. Compare mode of respiration in the following: a tadpole, a frog, a snail, and a fish. How are these differences connected with their environment?
3. Write notes on the following and illustrate with drawing: rhizome, corn, growth of dicotyledon stem, elementary canal of a bird.
4. Make a labelled diagram of the circulation of a frog and describe the circulation. Why are the amphibians cold blooded vertebrates? Briefly mention the characteristics of amphibians.
5. Describe the structure of a dicotyledon leaf and compare it with a mono cotyledon leaf. Illustrate with drawings.

6. Describe one function of a leaf.
7. State the characteristics of reptiles and compare with birds.
8. Draw and describe a vertical section of a stem and compare with that of a root. What are the functions of a stem.
9. Give an account of the internal and external structure of an earthworm.
10. What is the difference between pollination and fertilization?

School f -

- I. What do you understand by blood circulation in regard to the following terms:

artery vein auricle ventricle
systole diastole frequency of the heart cycle.

- II. Explain very briefly what happens:

- a. If the heart auricles are disturbed.
- b. If the heart ventricles are not functioning properly.
- c. If the intrinsic factor of the heart is at fault.
- d. If there is no haemoglobin in the red cells of the blood.
- e. If there is no plasma in the blood stream.

- III. Discuss the blood elements in regard to:

structure quantity function importance

- IV. How and where are the following found and stored in our bodies:

Protein Fats Carbohydrates

School g -

- N.B. Answer the first two questions and any other four questions of the remaining five:

- I. Define fully the following terms - choose ten out of twelve:

1. protoplasm 2. metabolism 3. euglena 4. golgi bodies

5. osmosis 6. tricuspid valve 7. vitamins
 8. ductless gland 9. type B 10. homologous parts
 11. sebaceous glands 12. varicose vein.

- II. Draw, label and describe how is the blood filtered in the kidneys from its nitrogenous substances which are excreted as urine.
- III. Describe briefly the five factors that control the rate of metabolism in the organism.
- IV. Trace a mouthful of meat from the time it is ingested until it reaches the liver.
- V. Discuss the last three stages in Mitosis and briefly state the characteristics of each.
- VI. What do you understand by External Respiration and show how our lungs function in this life process.
- VII. Name and briefly describe the 4 body defenses that destroy germs or render them harmless.

School h -

I. Write a short definition for each of the following words:

- | | |
|----------------------|--------------------|
| 1. biology | 11. tissue |
| 2. cross-pollination | 12. drone bee |
| 3. molt | 13. environment |
| 4. element | 14. exoskeleton |
| 5. compound | 15. endoskeleton |
| 6. photosynthesis | 16. regeneration |
| 7. chlorophyl | 17. organic matter |

- | | |
|----------------|---------------------------|
| 8. oxidation | 18. protective coloration |
| 9. osmosis | 19. metamorphosis |
| 10. protoplasm | 20. parasitism |

II. Write answers to the following questions. Number the points in your answers.

1. What are the four central ideas of biology? (1, 2, 3, 4,)
2. List and define the seven processes or functions that all forms of life have in common.
3. What are the three main kinds of adaptations of animals?
4. List the four elements which are most important in the study of biology.
5. What is energy? Include in your answer the two kinds of energy and the four different forms of energy?
6. To what kingdom, phylum, class, and order does the grasshopper belong?
7. Give four reasons why the grasshopper is a good example of the insects?
8. List at least four of the results of the life activities of the grasshopper.
9. Name four kinds of harmful insects and two kinds of helpful ones.
10. Give three reasons why there are so many insects.
11. What are the four main methods of controlling insects?
12. What are four things which we can do to keep moths from eating our clothes?
13. What is the name of the external parasite that sometimes lives on people? Tell two ways in which these parasites are spread?

14. List three ways in which the number of mosquitoes can be reduced?
15. Why is it important to reduce the number of mosquitoes? One reason.
16. What disease is carried by the house fly?
17. List four ways to reduce the number of house flies.
18. Name the four stages in the metamorphosis of the Monarch butterfly (use illustrations, if you need to).
19. Name three ways in which ants behave or act like people.
20. Give one reason why crustaceans are important to man.

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ABSTRACT

A. The Problem of the Study:

To discover what changes, if any, should be made in the entire field of biology teaching in Lebanon so as to render it more effective in the development of enlightened and capable citizens.

B. The Method of the Study:

1. The modern literature about biology teaching was investigated to obtain a broad general view of biology teaching as it is seen by the foremost thinkers in the field.
2. Three different types of questionnaires were distributed to biology teachers in the secondary schools of Lebanon, biology students in the secondary schools of Lebanon and Freshman and Sophomore students in the American University of Beirut.
3. Thirty-eight secondary schools of Lebanon were visited for the purpose of interviewing biology teachers and attending biology classes.

C. The Organization of the Study:

The Problem is treated along the following lines:

1. The aims of biology teaching.
 - a. The existing aims of biology teaching in Lebanon.
 - b. The aims of biology teaching in modern educational thought.
 - c. Recommended aims of biology teaching for the secondary schools of Lebanon.
2. The subject matter of biology teaching.

- a. The existing subject matter of biology in Lebanon.
 - b. The subject matter of biology in modern educational thought.
 - c. Recommended subject matter of biology for the secondary schools of Lebanon.
3. The Methods of biology teaching.
- a. The existing methods of biology teaching in Lebanon.
 - b. The methods of biology teaching in modern educational thought.
 - c. Recommended methods of biology teaching for the secondary schools of Lebanon.

D. The Findings of the Study:

1. Biology teachers in the secondary schools of Lebanon consider the following to be the most important aims of biology teaching.
 - a. Developing the right attitude toward the conservation of natural resources.
 - b. Helping the students to learn and practice the principles of healthy living.
 - c. Developing scientific attitudes.
2. In general, biology teachers in Anglo-Saxon type schools attach more importance to the needs of students in their daily lives than biology teachers in Latin type schools. Biology teachers in Latin type schools give more emphasis to the acquisition of scientific methods and attitudes than biology teachers in Anglo-Saxon type schools.

3. There is a notable difference between the aims chosen by biology teachers and those reported by biology students. Whereas students considered the acquisition of subject matter the most important aim, teachers tended to emphasize the utility of biology learning and the development of scientific methods and attitudes.
4. In general, biology teachers are dissatisfied with the available biology textbooks. A good biology textbook especially written for Lebanon is a real need.
5. The grade level of biology instruction varies widely in the secondary schools of Lebanon. In general the tendency is to offer biology in the fourth secondary year in order to teach chemistry and physics in the fifth and sixth years.
6. Several different teaching methods are practised in biology classes. The most common methods used are the recitation and the lecture; and the methods least used are the socialized method and the laboratory.
7. In general biology teachers do not engage in activities such as taking students on field trips, taking students to medical schools, etc.
8. The majority of secondary schools of Lebanon do not have a biology laboratory or biology laboratory equipment.

E. Conclusion of the Study:

1. The major aims of biology teaching should be:
 - a. To develop the ability of students to meet effectively the biological needs of life.
 - b. To develop the ability of students to apply scientific methods and to acquire the attitudes of scientists.

2. General science in the first three classes of secondary education should be centered on biology.
3. The biology syllabus should be based on the life functions of organisms.
4. Biology teachers should practise a greater variety of methods, demonstration and individual laboratory work should be an integral part of the biology program.
5. Laboratory instruction should limit the number of experiments which aim at verification and description. Rather it should be of a type which will evoke creative thought and discovery.
6. Biology teachers should be well-trained both in their subject matter and in education.
7. The principles given in the thesis for the effective application of the various methods should be examined and tried by biology teachers.
8. The Lebanese Baccalaureat program should be examined and modified. The American University of Beirut should prepare a special syllabus in Biology for secondary schools.
9. Both the Education and Biology Departments at A.U.B. should cooperate in training biology teachers.
10. A "Secondary School Biology Teachers' Association" should be organized. The main job of the Association should be:
 - a. To prepare a biology textbook for secondary schools.
 - b. To publish a biology magazine for biology teachers and students.
 - c. To prepare an Arabic-English dictionary for biological terms.
 - d. To encourage talented young students to be biologists.
 - e. To operate an audio-visual center serving Lebanese secondary schools.