

A COMPARISON OF CERTAIN GROUPS OF STUDENTS IN NEW PLAN  
BIOLOGY CLASSES IN THE EXPERIMENTAL JUNIOR COLLEGE  
OF KANSAS CITY, MISSOURI

by

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## PREFACE

This thesis was undertaken especially because of a need felt by the writer to determine the degree of difficulty existing between the preparatory courses in the biological field for College Biology, and to ascertain which courses seem to be the better fitted for the local needs. The writer is desirous of determining, if possible, some path for future action in regard to the courses.

The writer wishes to express his gratitude to Dr. C. V. Williams for his helpful influence during the entire preparation of this thesis; to the late Dr. W. H. Andrews and Professor Roy C. Langford for statistical advice; and to Dr. E. L. Helton, Dr. V. L. Strickland, and Superintendent W. E. Sheffer for criticisms during the completion of this work.

## INTRODUCTION

### Background

The administration of the Public Schools of Kansas City, Missouri, feeling much the same weaknesses in the correlation and articulation between secondary and higher education as independently expressed by several thinkers the country over, went before the North Central Association of Secondary Schools and Colleges early in 1929 with a request for the sanction of that body on an educational experiment which is now called the New Plan Junior College Experiment of Kansas City, Missouri.

The permission and encouragement given by the Association set the mills grinding on the new task. The routine of the planning was so great that not until the fall of 1930 was it possible to begin the New Plan. In the fall of that year Northeast High School in Kansas City was chosen as the best location for trying the experiment.

Approximately one-third of the sophomores (176 of them) began their eleventh year work as New Plan I students rather than regular high school juniors. Each succeeding year about the same number of students have elected of their own

accord to enter the New Plan, and this year (1933) there were graduated 78 students, 50 of which are prepared to enter standard colleges as juniors. The rest of the graduates do not have grades which recommend them without condition.

The fundamental premise of the New Plan is that students can do the four years work in three years by the elimination of duplications and by having closer supervision than is usually the rule during that period. Therefore, the student who is able and willing enters the New Plan when he would normally be an eleventh grade student, and arrives at the fifteenth grade of school in three instead of four years.

To achieve this end the students are given a year's work in courses that have been carefully revamped to take the place of the last two years in a standard high school and to prepare the student for work of regular college standards. During the second and third years of the New Plan the students assume work distinctly of college freshman and sophomore rank. By the time the student has completed the three years, he has become able to assume the responsibilities accruing to one who has completed the sophomore year of a regular four-year college.

Since this thesis is concerned mainly with the Biology

division of the Plan, it is now time to give a more detailed account of the set-up of that department as it now functions. All Kansas City high school students must take either General Science in the ninth grade or Biology in the tenth grade. Since students from each of these two preliminary preparations enter the New Plan, those who have taken the General Science are given a survey course in Biology called Life Science, while those who had the Kinsey<sup>2</sup> high school Biology are given a survey course called Introduction to Science in which one semester is devoted to Chemistry and the other to Physics. In the Life Science course, Wheat and Fitzpatrick<sup>11</sup> is used as the basic text.

All students of the New Plan who are candidates for the Liberal Arts and Sciences degree are required to take College Biology, a five semester hour course, and so come into the College Biology with two different backgrounds as far as course preparations are concerned. Since part of the program of the New Plan is the elimination of duplications in materials offered as well as caring for the people with different preparations, it is inevitable that many problems and questions arise regarding different phases of the experiment. It is within the province of this thesis to set up some rather definite questions, ascertain from proper data the answers to the questions, and to attempt

solutions to the problems suggested by the questions.

Foremost among the questions are some of the following:

1. Which students make the better grades in College Biology, those who are high school-prepared or those who are survey-prepared?

2. What correlation exists between the grades made in the preparatory work and in the college work?

3. What correlation exists between the standing of the students according to the intelligence tests for which there is record and the grades actually made by those students? What relation is there to certain other standard tests, other than intelligence tests, for which there are available data?

4. What specific correlation exists between the Ruch-Cosman Biology<sup>9</sup> tests and the actual grades earned?

#### METHODS USED

Since all these students came under the direct teaching and supervision of the writer, it was a relatively easy matter to collect data on the group. Grades made in the preparatory work were taken from the office files, as were the data on the Terman Group Test of Mental Ability,<sup>10</sup> which is given to all Kansas City students in their freshman year.

The other test scores were secured from the Educational Counselor who gave them to the New Plan students as a select group, with the exception of the Buch-Cossmen Biology Tests<sup>9</sup> which were given by the writer to 113 of the 165 students. The fact that 52 students were not given the Buch-Cossmen Test is due to the writer never realizing that any great differences were present in the two groups of students until their semester grades had been compared. At that time the students were well along in the next semester of work in other courses. All the rest of the students (113 of them) were given the Biology tests.

Nearly a year and a half was spent in collecting the data which had to be tabulated after the completion of the spring semester of 1933, and so, necessarily, had to be done in the summer school of that year.

Statistical methods were used largely to account for the degrees of difference, the reliability of the supposition that the differences were not due to chance, and to furnish a basis for judgment of the meanings of the differences. Each section of the thesis has further mention made of the specific methods used in connection with that section.

ACHIEVEMENTS IN PREPARATORY AND COLLEGE  
WORK COMPARED

One of the first striking features of the grades made by the students in the College Biology was the apparent variability existing between the final grades secured in the College Biology and the grades made by those same students in their preparatory work. The students who took the college course had been prepared by either regular high school Biology with Kinsey<sup>2</sup> as the basic text, or by the survey course in Life Science in the first year of the New Plan with Wheat and Fitzpatrick<sup>11</sup> as the basic text. This difference became all the more striking when an examination of the grades made in the preparatory work showed that while the students who took high school Biology made higher average grades than those who took the Life Science, the reverse was true when these students took College Biology.

By arbitrarily assigning a zero index to a failing (F) grade, two to an inferior (I) grade, four to an average (M) grade, six to a superior (S) grade, and eight to an excellent (E) grade, it was possible to secure certain numbers of summation which represent the actual differences between the grades secured in the various classes. The intermediate indices are due to the fact that a student does not always

make the same grade both semesters in the preparatory work. There can be no intermediate indices in the case of the college work which covers only one semester.

These indices were tabulated and appear in Table I. This table shows that the entire 165 students made an average index of 4.77 or M-plus in their preparatory courses, while the same students attained an index of only 2.994 or a very strong I-plus in their College Biology. All 165 students had an average index 1.776 lower in their college work than in their preparatory work. This corresponds to a decrease of .888 grade units, or approaching a decrease of one entire grade step.

The difference is even more noticeable when the students are compared in groups according to their preparatory courses.

The students who are high school-prepared averaged an index of 5.186 for the 102 students involved. When these same students took the college work, they averaged an index of only 2.882, representing a difference of 2.304 or 1.152 grade units. These students have decreased from a very weak S-minus to a fairly strong I-plus.

The 63 survey-prepared students, on the other hand, averaged an index of only 4.095 in their preparatory work, but had an index of 3.175 in their college work, a differ-

TABLE NO. 1. DISTRIBUTION OF GRADES EARNED.

GRADES MADE BY COLLEGE STUDENTS IN PREPARATORY COURSES													
Indices	0	1	2	3	4	5	6	7	8	Total	H Average		
High School Biology	1	*	3	8	27	21	25	8	10	529	103	5.166	
Life Science	2	*	1	14	14	12	5	10	8	5	258	63	4.095
Total	3	*	1	17	22	39	26	35	10	15	787	166	4.77

  

GRADES MADE BY SAME STUDENTS IN COLLEGE BIOLOGY													
Indices	4	5	6	7	8	9	10	11	12	Total	H Average		
High School Biology	4	15	*	46	*	25	*	13	*	3	294	103	2.862
Life Science	5	15	*	16	*	18	*	8	*	6	200	63	3.175
Total	6	30	*	62	*	43	*	21	*	9	494	166	2.894

Note: Read Table I thus--line two shows 14 students each making grades with indices of 2 and 3 in the Life Science. The sum of the index-products is 258 and the average index for the entire group is 4.095, or slightly above an M. Line four shows 15 students with a zero index. The sum total of the indices is 200, with an average index of 5.175, or an average of an M-minus for the Life Science Students when they took College Biology. The values for the indices are: 0 equals F, 2 equals I, 4 equals M, 6 equals S, and 8 equals E. The intermediate indices are obtained because in the preparatory courses the student does not always make the same letter grades each semester. The college grades have no intermediate indices because the course covers only one semester.

ence of only .920 or .46 grade units. So the latter students decreased from an M to an M-minus.

Examination of the grades now shows that while the high school-prepared students had higher initial grades on entering the college work than the survey-prepared students, the latter made better grades in the college work. Considering the high school Biology students as the standard of comparison, the survey-prepared students made only 78.9 per cent as high grades as the high school-prepared students in their preparatory work, but attained a percentage of 110 in their college course. Apparently the survey course is a better preparation for continuation in the biological sciences in college than is the high school course.

However, the question can be easily raised whether or not, with the small numbers of students, this difference might be due to chance, varied intelligence, or any other factor the critical person might wish to assume to be the real cause of the difference.

In order to determine to some extent whether the differences are real or due to chance, the grade distributions were worked out and tabulated as shown in Table II. This table shows the average grades with their standard errors, the standard deviations with their standard errors, and the critical indices worked from the difference of the means

TABLE NO. II. COMPARISON OF MEANS, DEVIATIONS, AND CRITICAL RATIOS.

GRADES MADE IN THE PREPARATORY COURSES						
Groups	Mean	SE of Mean	Standard Deviation	SE of SD	Critical Ratio	N
H. S. Biology	5.186	± .148	1.499	± .105	3.924	102
Life Science	4.095	± .236	1.874	± .167		63
GRADES MADE IN COLLEGE COURSE BY SAME STUDENTS						
H. S. Biology	2.882	± .219	2.209	± .155	-.775	102
Life Science	3.175	± .309	2.458	± .218		63
GRADES TOTAL FOR PREPARATORY AND COLLEGE COURSES						
Preparatory	4.770	± .187	1.768	± .097	9.06	165
College	2.994	± .140	1.804	± .099		165

Note: Read Table II thru--the critical ratio of life science grades compared to High School Biology grades is 3.924, where the average grades plus-or-minus the standard error, or the mean, and the standard deviations plus-or-minus the standard error of the standard deviations are of the values as shown in the table.

The last two lines show the values and comparisons for all the students grouped according to the average grades made by the 165 students in both preparatory and college courses.

divided by the standard error of the difference of the means. The 102 students from the high school preparation are used as unity, or standard of comparison, and will be so used throughout this thesis.

The critical ratio of the means of the high school-prepared and survey-prepared students was found to be 3.924. This is very significant in that there is excellent reason to believe the difference is not due to chance. A ratio of 3.00 is taken to mean that difference is not due to chance, while the additional .924 in the index is indication of that much more proof that the difference was not due to chance in any way.

The critical ratio between the means of the achievement of the same two groups of students when they took the college course was found to be -.775. This ratio is significant only in that it indicates the direction of the difference, or that, where the high school-prepared students made higher grades in their preparatory work than did the survey-prepared students, the reverse is now true, the survey-prepared students making the better grades in the college work. The -.775 ratio, being less than 3.00, is only 25.8 per cent what it should be to insure practically complete reliability.

The critical ratio between the means of the 165 preparatory grades and corresponding college grades was then cal-

culated to learn what comparative statistical differences might exist between the differences readily discernible by inspection. This ratio was found to be 9.06, a figure sufficiently large to more than verify the supposition that these differences were most certainly not due to chance.

Since a difference does exist in the attainments of the students in the different groups, and apparently these differences are not due to chance entirely, the question arises regarding the relation that exists between the differences. To determine the degree of correlation between the preparatory grades and the college grades, the product-moment method of correlation was used. The results are shown in Table III.

TABLE NO. III. CORRELATION BETWEEN THE PREPARATORY COURSE GRADES AND THOSE MADE IN THE COLLEGE BIOLOGY COURSE.

Group	r	SE	N
H. S. Biology	.47	± .077	102
Life Science	.84	± .037	63
Total	.51	± .058	165

Note: Read Table III thus--the coefficient of correlation between the 63 Life Science and college grades is .84 with a standard error of .037.

When the distributions were made for the three groups that are tabulated, it was readily apparent that there were differences and, also, the direction of those differences, although the statistical amounts of the differences had not yet been calculated. The coefficient of correlation between the 165 preparatory course grades and the 165 college grades was found to be .51, indicating a fair amount of correlation. The 102 students that were high school-prepared showed a correlation of .47, or a slight amount of correlation. The 63 survey-prepared students showed a correlation of .84, or a very high correlation. This coefficient of correlation shows there is a high degree of agreement between the grades made by the survey-prepared students in their preparatory course and their grades earned when they take the college work.

#### SUMMARY

1. A marked difference actually exists between the grades made in the preparatory work and those made in the college work of students in the New Plan. The distribution of and average of the grades makes the differences rather striking.

2. The differences are significant and are not due en-

tirely to chance, only one of the critical ratios being of questionable size; however, it indicates the direction of the difference.

3. Apparently the survey course in Life Science is a better preparatory course than is high school Biology to insure success in College Biology. This supposition is borne out, not only by the fact that the survey-prepared students made higher grades in College Biology than did the high school-prepared students, but by the high correlation existing between their college and preparatory grades as compared to the low correlation existing between the high school-prepared students' college and preparatory grades.

4. Life Science is apparently a more difficult course for students than the high school Biology, as shown by the comparison of grades made by the students while taking the courses.

5. The question of mental ability has not been answered. This question comes within the province of the next section of the thesis.

CLASS ACHIEVEMENT AND INTELLIGENCE  
TESTS COMPARED

All students of Kansas City take the Terman Group Test of Mental Ability<sup>5</sup> during their ninth year in the schools. In addition, all students who elected the New Plan are given the Otis Self-Administering Test of Mental Ability<sup>6</sup>. The results of these tests were tabulated and the decile rank of each student found for the respective tests. The distribution of the high school-prepared and survey-prepared students appears in Table IV.

It will be noted that the survey-prepared or Life Science students had a slightly higher average in both the Terman and the Otis tests, and that in both cases better averages were made on the Terman than on the Otis test. The survey-prepared students did 113 per cent as well as the high school-prepared students in the Terman test, and slightly less than 107 per cent as well in the Otis test. At the same time the high school-prepared students did only 84 per cent as well in the Otis as in the Terman, while the survey-prepared students only did 79 per cent as well in the Otis as in the Terman tests.

The foregoing would seem to indicate that, according to the tests given, the 165 students averaged a little above

TABLE NO. IV. DISTRIBUTION OF INTELLIGENCE TEST DECILES.

TERMAN MENTAL ABILITY DECILES													
Group	1	2	3	4	5	6	7	8	9	10	Total	N	Average
H. S. Biology	0	0	11	11	12	18	11	7	0	17	643	102	6.30
Life Science	*	*	5	8	9	1	10	3	12	15	450	63	7.14
OTIS SELF-ADMINISTERING DECILES													
H. S. Biology	8	10	13	14	10	14	8	8	9	8	533	103	5.27
Life Science	10	6	2	5	4	7	6	9	9	5	355	63	5.65

Note: Read Table IV thus--the H. S. Biology students were distributed on the Terman test into deciles as shown, with a total decile-index of 643, or average of 6.30 for a total of 102 students. This corresponds to 68 percentile for these 102 students.

In the Otis test these same students were distributed to have a total decile-index of 538, or corresponding to a 52.7 percentile for a total of 102 students.

the mean for the city, or approximately the 65 percentile on the Terman test, and are, therefore, somewhat better in mental capacity than the average Kansas City ninth grade students. The fact that the entire 165 students had only a 54 percentile average in the Otis test tends to show that they are a fairly representative cross-section of the group that elected to try the New Plan.

In order to get further information relative to the comparative achievement of these 165 students according to their respective preparations, the standings in each of the mental ability tests were correlated by the product-moment method, and the coefficients of correlation existing between each of the two tests and the grades made by the two groups of students in both their preparatory and college courses are shown in Table V.

A distinct difference in the coefficients of correlation is at once apparent, notably, that a higher correlation exists in nearly all respective cases between the Otis test and the actual grades made in all courses than between the Terman test and the actual grades made in all courses. This may be taken to mean that the Terman tests are not as reliable for testing native ability as are the Otis tests. The relatively low correlations existing between the intelligence tests and the grades made in all subjects may be

TABLE NO. V. CORRELATIONS BETWEEN THE TERMAN AND  
THE OTIS INTELLIGENCE TESTS AND THE  
GRADES ACTUALLY SECURED.

TERMAN MENTAL ABILITY	
Grades Made	r
Preparation in H. S. Biology	.47
Preparation in Life Science	.22
College after H. S. Biology	.39
College after Life Science	.25
OTIS SELF-ADMINISTERING	
Preparation in H. S. Biology	.58
Preparation in Life Science	.44
College after H. S. Biology	.53
College after Life Science	.40

Note: Read Table V thus--the correlation between the Terman test and the college grades made after a preparation of Life Science is .25, while between the same grades and the Otis test the correlation is .40.

taken to mean that the students who elect the New Plan are a more highly selected group, for in such cases the coefficient of correlation tends to decrease. This agrees perfectly with the true state of affairs, since many students who finish the ninth grade never go farther in their education, and, in general, only average or better students elect the New Plan.

One other apparent feature is that, in the case of the Otis test correlation with the grades earned by survey-prepared students in their college work, the survey-prepared students make grades more nearly comparable with their standing in the Otis test. At the same time, the high school-prepared students have a lower coefficient of correlation between the same variables. This bears out the contention made in the previous section of this thesis that the survey course is a better preparation to insure success in College Biology. This contention becomes even more convincing when the fact is considered that the survey-prepared students are a more select group than are the high school-prepared students.

It also seems certain that the Otis test is a better measure for predicting success in college work than is the Terman test.

## SUMMARY

1. The 165 students are above the Kansas City average on the Terman test, while they seem to represent a very good cross-section of the students in the New Plan.

2. A higher correlation exists between the Otis test and actual grades made in nearly all courses than exists between the Terman test and grades made in all courses.

3. A lower correlation exists between the tests and the college grades than exists between the tests and the preparatory grades. This is surely indicative of greater selection in students doing the college level of work.

4. The fact that a higher correlation exists between the Otis test and the grades made by the survey-prepared students in the college work than exists between the high school-prepared students' grades and the Otis test shows that the Otis test is a better yardstick to predict success in college than is the Terman test.

CLASS ACHIEVEMENT AND CERTAIN TYPES OF  
ENGLISH TESTS COMPARED

The comparatively low, but yet significant, correlations secured between the intelligence tests and the grades

actually secured in both the preparatory and college Biology courses made it advisable to secure further standards of comparison. Two types of English tests were available, the Pribble-McCrory Language Test<sup>7</sup> and the Nelson-Denny Reading Test<sup>4</sup>. The scores made by the 165 students were arranged into deciles, according to the preparatory work in Biology, and the correlations calculated for both the preparatory and the college work.

Table VI shows the students distributed into deciles on each of the tests. It will be noticed that in each case the entire groups are only slightly above the average. In fact, they are so close to average that it is probably not worth while to think of them otherwise than average for all groups when making further comparisons.

The coefficients of correlation in Table VII are not materially different in amount from those existing between the intelligence tests and the work done in preparatory classes and college classes. However, again we find one test showing a slightly better correlation, in general, than the other. The reading test has a higher general correlation with grades made than does the language test. The correlation is slightly better, on the average, between the preparatory work in the high school course and both tests than it is between the survey course and the tests. This is

TABLE NO. VI. DISTRIBUTION OF CERTAIN ENGLISH TEST DECILES.

FRIBBLE-McCRORY LANGUAGE DECILES													
Group	1	2	3	4	5	6	7	8	9	10	Total	% Average	
H. S. Biology	12	8	11	13	10	7	7	10	9	16	565	102	5.54
Life Science	5	9	5	5	4	11	8	9	5	2	337	63	5.35
NELSON-DENNY READING DECILES													
H. S. Biology	9	11	9	10	11	11	10	8	12	11	571	102	5.59
Life Science	9	6	5	9	3	9	4	6	4	6	329	63	5.22

Note: Read Table VI thus--on the Fribble-McCrorry Language Test, the H. S. Biology students were distributed into deciles as shown with a total decile-index of 565, or an average of 5.54 deciles corresponding to the 55.4 percentile.

In the Nelson-Denny Reading Test these same students were distributed in such manner that they averaged 5.59 corresponding to the 55.9 percentile for these same 102 students.

TABLE NO. VII. CORRELATIONS BETWEEN THE FRIBBLE-McCRORY LANGUAGE AND NELSON-DENNY READING TESTS AND THE GRADES ACTUALLY SECURED.

FRIBBLE-McCRORY LANGUAGE TEST	
Grades Made	r
Preparation in H. S. Biology	.40
Preparation in Life Science	.24
College after H. S. Biology	.40
College after Life Science	.50
NELSON-DENNY READING TEST	
Preparation in H. S. Biology	.48
Preparation in Life Science	.44
College after H. S. Biology	.57
College after Life Science	.57

Note: Read Table VII thus--the correlation between the Fribble-McCrory Language Test and the grades made in the preparatory work in Life Science is .24, while the college grades made by the same students have a correlation with the same test of .57.

probably due to the fact that there are fewer and, without doubt, more select students in the survey-prepared group of students.

A noteworthy part of the comparisons is that the correlations are higher, in three-fourths of the cases, between the actual grades secured and the standing on the reading test. This would seem to show that a reading test is a better criterion of scholarship than is a language test. One would rather expect such to be the case. The student who can read for a limited time and then make the better score on questions covering the material he has just read would be more likely to succeed in studies than one who could not remember what he had read.

#### SUMMARY

1. The correlation coefficients are not materially different between the grades made and the English tests than between the intelligence tests and the grades made.

2. There is a slightly higher coefficient of correlation existing between the reading test and grades made than between the language test and grades made.

3. The entire group of students has an index very close to average when distributed into deciles according to their scores on both the reading and language tests.

CLASS ACHIEVEMENT AND CERTAIN  
SCIENCE TESTS COMPARED

The comparisons between the grades actually made and the standard tests have so far been comparatively low, only a few instances having anything near a marked correlation. In order to ascertain better the true relationships of the variables with which the work has been done, two science tests were employed. One of these was the Science Division of the Iowa High School Content Test.<sup>8</sup> The scores were available for all 165 students. When these students were distributed into deciles according to their type of preparation, it was found, Table VIII, that the high school-prepared students had a higher average than did the survey-prepared students. This fact is in direct contradiction to the findings on the intelligence tests, where the survey-prepared students had the highest average intelligence ratings. Since the high school-prepared students made the highest scores in the High School Content Test, it is apparent that the survey-prepared students are given less material that is on the distinctly high school level. When we consider that the survey-prepared students make better grades in college than the high school-prepared students, the results of the test would add further proof that the

TABLE NO. VIII. DISTRIBUTION OF CERTAIN SCIENCE TEST DECILES.

IOWA HIGH SCHOOL CONTENT SCIENCE DECILES													
Group	1	2	3	4	5	6	7	8	9	10	Total	N	Average
H. S. Biology	6	10	8	10	9	14	11	10	11	14	608	102	5.96
Life Science	11	10	5	8	8	3	5	5	4	4	287	63	4.56
RUCH-COSMAN BIOLOGY TEST DECILES													
H. S. Biology	10	8	11	6	7	4	6	6	4	3	312	67	4.66
Life Science	1	3	2	5	7	6	4	5	7	6	298	46	6.41

Note: Read Table VIII thus--the H. S. Biology students distributed themselves on the Science division of the Iowa High School Content Test into the deciles as shown with a decile-index of 5.96 corresponding to the 59.6 percentile.

In the Ruch-Cosman test only 67 of the above 102 students who took H. S. Biology were given the test, and only 46 of the 63 Life Science students were given the same test. The reason is explained in the text of the thesis. Those 67 who took the Ruch-Cosman Biology Test had a decile-index of 4.66 corresponding to the 46.6 percentile.

survey course in Life Science is a better preparation for success in College Biology than is the high school Biology, even though lower grades are made on the average by the students in the survey course than by the students who take the high school Biology.

The Science Division of the Iowa High School Content Test<sup>8</sup> is devoted to rather general science questions, including only a limited proportion of strictly biological questions. In order to get a better comparison of achievements of the students in the New Plan Biology classes on a strictly biological test, the Ruch-Cossman Biology Test<sup>9</sup> was used.

This test, as stated in the Introduction, was given to only 113 students. Sixty-seven of these students were high school-prepared and 46 were survey-prepared. Table VIII shows their distribution by frequencies into deciles. In the Ruch-Cossman test the survey-prepared students averaged higher than did the high school-prepared students. This again bears out the statement that the Life Science survey course is a better course in biological science than is the high school Biology, in spite of the fact that the survey-prepared students had a higher intelligence rating than did the high school-prepared students.

Table IX shows the correlations between the two tests

TABLE NO. IX. CORRELATIONS BETWEEN THE SCIENCE  
DIVISION OF THE IOWA HIGH SCHOOL CONTENT  
AND RUCH-COSSMAN BIOLOGY TESTS AND  
THE GRADES ACTUALLY SECURED.

IOWA HIGH SCHOOL CONTENT SCIENCE TEST	
Grades Made	r
Preparation in H. S. Biology	.57
Preparation in Life Science	.13
College after H. S. Biology	.28
College after Life Science	.25
RUCH-COSSMAN BIOLOGY TEST	
Preparation in H. S. Biology	.51
Preparation in Life Science	.67
College after H. S. Biology	.77
College after Life Science	.67

Note: Read Table IX thus--the correlation between the Iowa High School Content Science Test and the grades made in the H. S. Biology Preparatory course is .57, while between the same students and the Ruch-Cossmann Biology Test the correlation is .51.

and the grades actually secured. On this table it will again be noted that there is relatively poor correlation, that of the Iowa test with the grades made being the poorest. As we would expect, the high school-prepared students exhibit the highest amount of correlation between the Iowa test and the grades made, while the survey-prepared students exhibit the lowest amount of correlation.

Turning to the part of Table IX which deals with the correlations between the Ruch-Cossman Biology Test<sup>9</sup> and the grades made we find that the high school-prepared students made a coefficient of only .51 between their high school Biology grades and the Ruch-Cossman test, while the survey-prepared students had a correlation of .67 between their standing on the Ruch-Cossman test and their grades made in the Life Science course. However, in the college grades made, the high school-prepared students had a coefficient of .77 as against one of .67 for the survey-prepared students between their respective college grades and the Ruch-Cossman test.

Table III has shown that a higher correlation exists between the preparatory grades and the college grades of the survey-prepared students than exists in the case of the high school-prepared students, a coefficient of .84 in the case of the survey-prepared students and only .47 in the case of

the high school-prepared students. So one would expect the coefficients of the survey-prepared students to be more nearly the same than in the case of the high school-prepared students. Thus the coefficient of .67 in the preparatory work and .67 in the college work of the survey-prepared students is more reliable than the coefficients of .51 in the preparatory work and .77 in the college work of the high school-prepared students.

When it is further taken into account that the standings of the students on the Ruch-Cossmann test in no way influenced the final grades assigned and that the correlations between the grades made in the classes and the Ruch-Cossmann test were larger than with other tests in spite of the fewer numbers of students, we can easily understand that the correlations between the Ruch-Cossmann test and work actually done are more valuable than the correlations with any other single test used. The uniformity of the coefficients in the case of the survey-prepared students would tend to show that the Life Science course is a more reliable type of preparatory training in Biology than is the high school Biology course.

## SUMMARY

1. The high school-prepared students made higher averages on the Science part of the Iowa test than did the survey-prepared students. Just the reverse was true in the case of the 113 students who took the Ruch-Cossman Biology Test.

2. The high school-prepared students made higher average correlations with the Iowa test than did the survey-prepared students. The reverse was true again in the case of the Ruch-Cossman test, although not to quite the same extent.

3. Additional proof has been given from the data on these tests that the Life Science survey course is better preparation for success in College Biology than is the high school Biology course.

GENERAL SUMMARY, CONCLUSIONS, AND  
RECOMMENDATIONS

The apparent differences between the achievements of students, according to their preparations, in the college course are real differences and are not due to chance. Ample proof of this statement is shown in the size of the

critical indices, which are over three in all cases but one.

The high school-prepared students make the better grades in their preparatory work but when they come to the regular college courses they make the poorer grades. There is scant doubt, as shown by the data and correlations, that the Life Science survey course is a better preparatory course for success in College Biology than is the high school Biology course. The fact that the survey-prepared students have a higher intelligence standing than the high school-prepared students tends to minimize this statement to some extent, but the accompanying fact that the survey-prepared students make lower average grades in their preparatory work just about compensates for the intelligence rating. With a higher intelligence they should make higher grades in their preparatory work. Failure to do this may be because the survey course is more difficult.

Comparisons between the English tests and final grades earned do not exhibit high correlation but do tend to show that reading ability is of more value in securing high grades in a biological science than is language ability. The rather extensive use of objective tests in the courses would tend also to make the reading ability of the greater value.

Class achievement shows markedly higher correlation

with the Ruch-Cossman Biology test than it does with any of the intelligence or English tests. This fact is rather to be expected, as the two are more nearly related. The smaller numbers of students taking the Ruch-Cossman test as compared to the other tests, with the greater coefficients, tend to make these coefficients all the more significant.

Any recommendations made by the writer would very necessarily be in the direction of the need of further research. The number of cases, 165, is rather small. A larger number of cases would furnish more significant coefficients of correlation. The coefficients might be either greater or less, but in any event would increase in significance.

If the New Plan is to be a success as far as elimination of duplications are concerned, it would be very much worthwhile to evaluate the content of the science tests, particularly to ascertain what things are missed by the high school-prepared students and what things are missed by the survey-prepared students. From careful consideration of the data thus secured, it might be possible to work out an even better survey course in the Life Science and to suggest changes in the high school Biology course which would enable those students to be better prepared to assume work of the college level.

This thesis has served to establish the fact of the existence of differences in achievement. Thus the greater field is opened to research, the field of determining the content material or lack of content material which is the cause of these differences, and then the field of endeavor which would definitely reorganize the biological science courses so that they would better serve the interests of the students enrolling in College Biology.

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