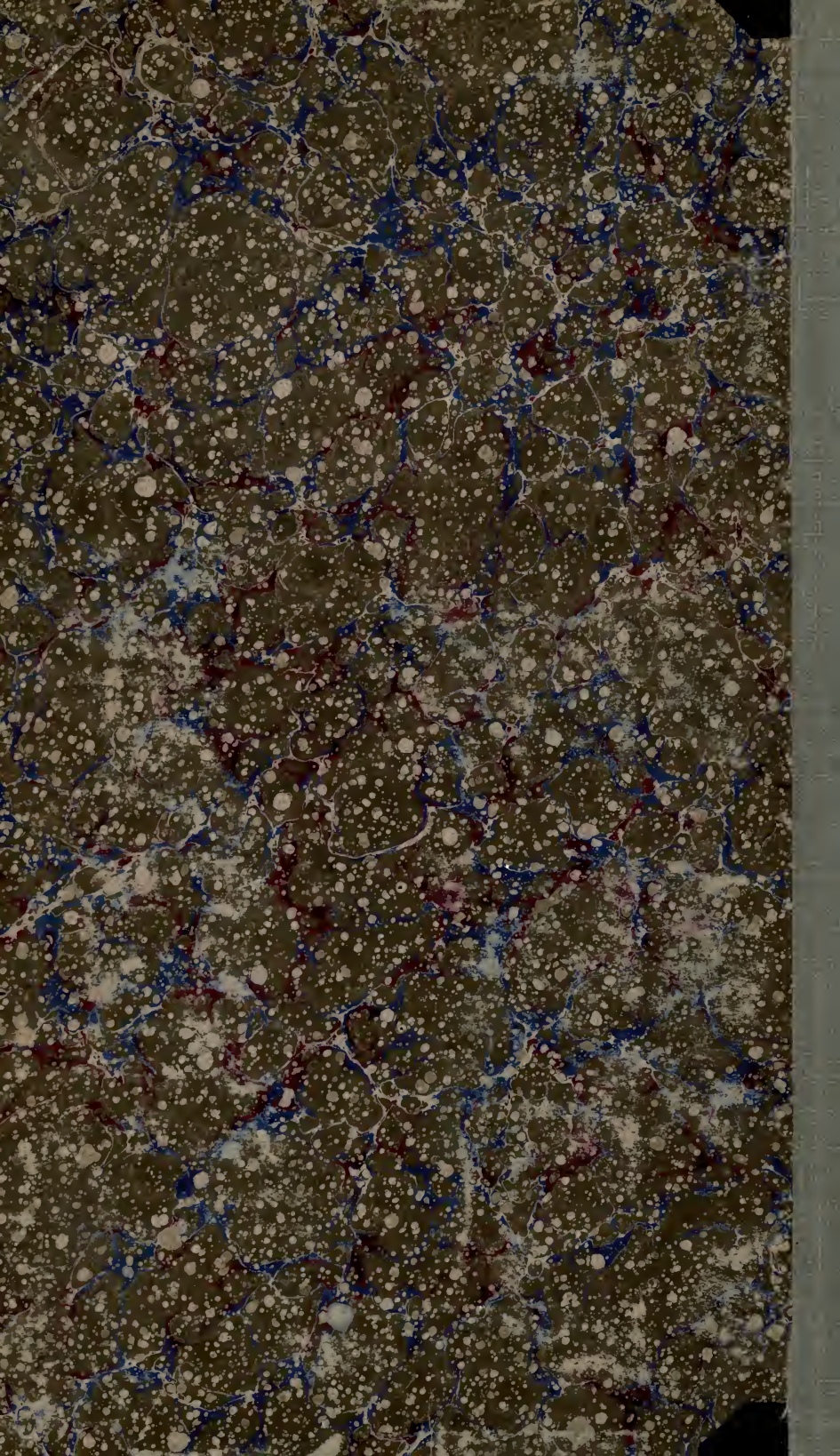
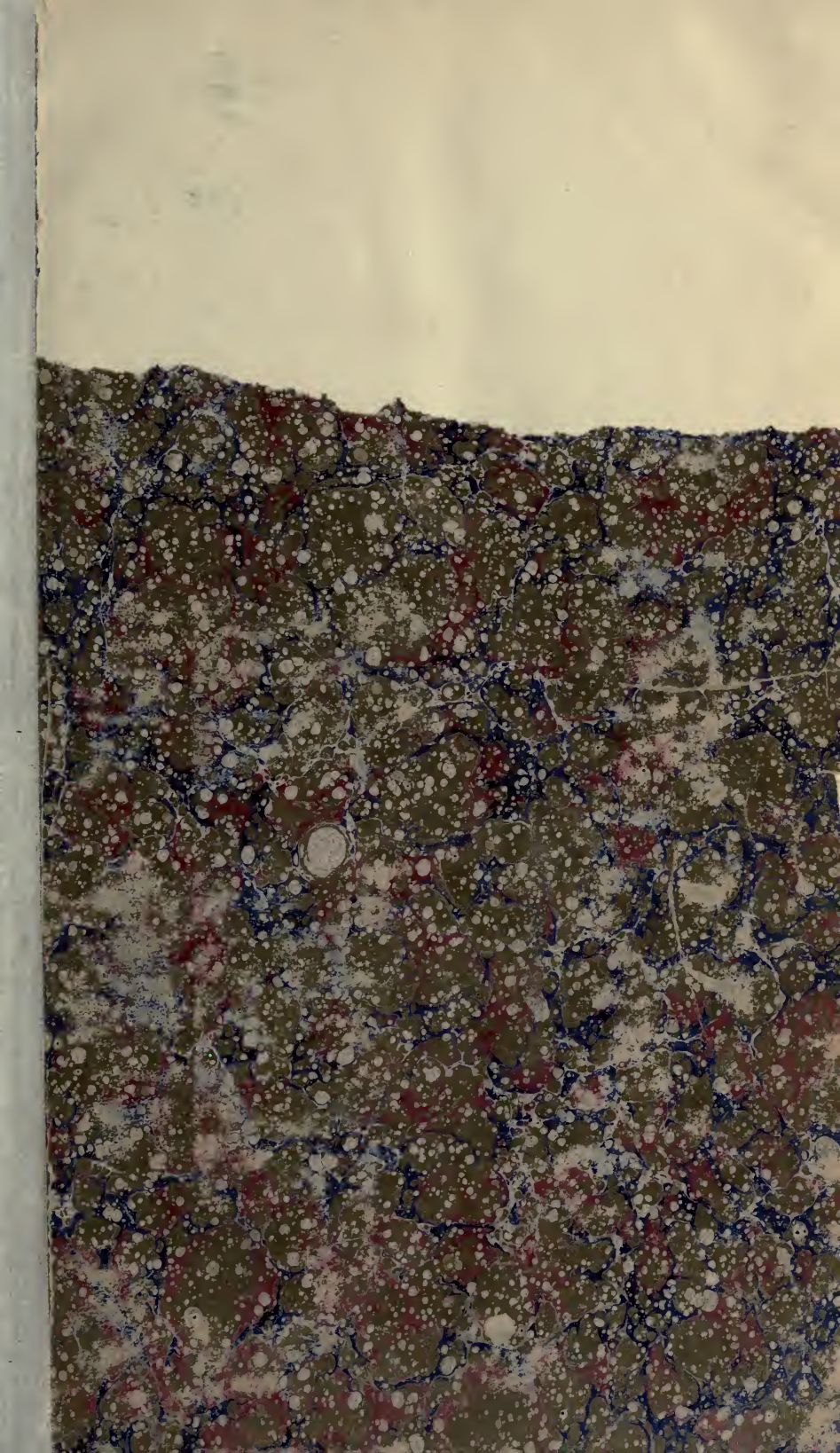
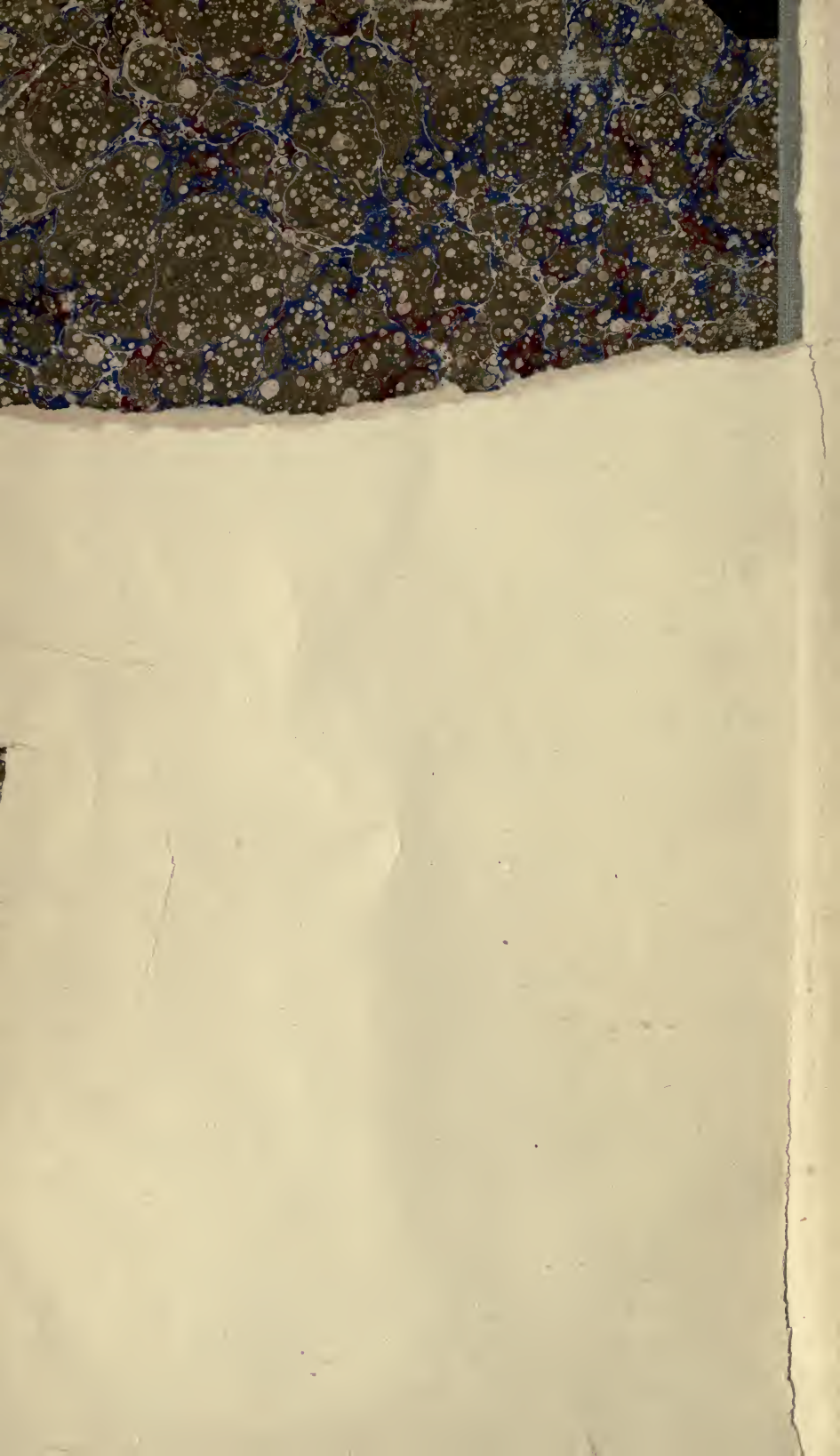


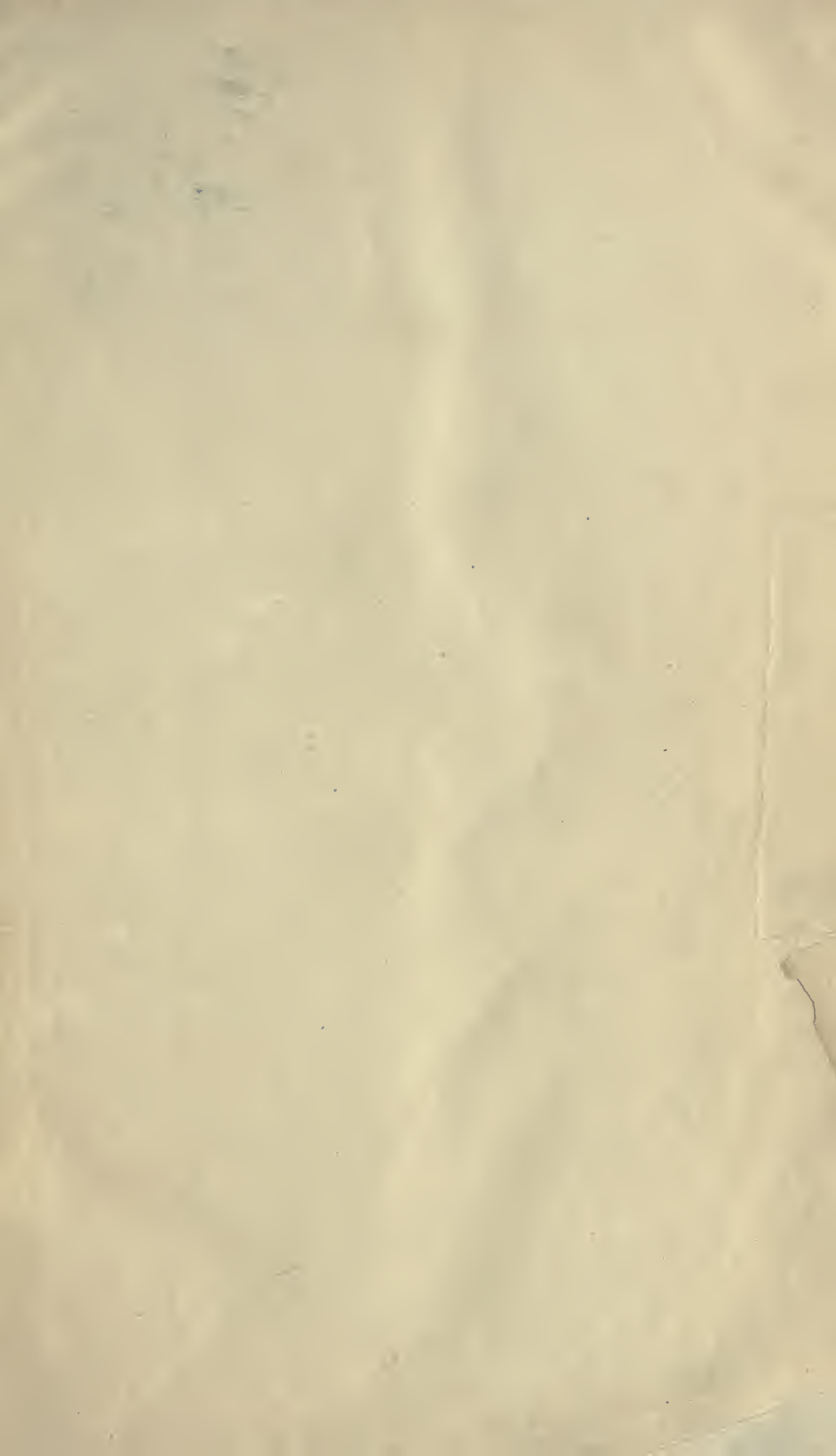
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AMERICAN ECONOMIC ASSOCIATION.

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# THE STUDY OF STATISTICS IN COLLEGES.

By CARROLL D. WRIGHT.

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A PAPER READ BEFORE THE JOINT SESSION OF THE AMERICAN  
ECONOMIC ASSOCIATION AND THE AMERICAN HISTORICAL  
ASSOCIATION, AT SANDERS THEATRE, HARVARD  
UNIVERSITY, MAY 24, 1887.

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THE

## STUDY OF STATISTICS IN COLLEGES.

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BY CARROLL D. WRIGHT.

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America has no counterpart to the continental school of statisticians, whose members have entered their particular field of science after special training by a systematic course of instruction. We have our statisticians, to be sure, but they have taken up their work accidentally, and not as a profession. Men engaged in the practice of law or of medicine, or in the other learned professions, enter them only after careful preparation. Our government trains its soldiers and sailors ; our colleges and higher institutions of learning fit men for various special scientific and professional labors, but we have not yet reached the advanced stage of educational work in this country which comprehends administration in its broadest terms. The European has an advantage over those engaged in statistical work in this country. Many of the leading colleges and universities of the continent make special effort to fit men to adopt statistical science as a branch of administration, or as a profession.

Körösi, Neumann-Spallart, Ernst Engel, Block, Böhmert, Mayr, Levasseur, and their score or more of peers, may well excite our envy, but more deeply stimulate the regret that one of their number, from his brilliant training and his scientific attainments, can not present to you today the necessity of copying into the curricula of our American colleges the statistical features of the foreign school. For magnificent achievement the American statistician need not blush in the presence of the trained European, for, without conceit, we can place the name of our own Walker along with the names of those eminent men



I have enumerated. With all the training of the schools, the European statistician lacks the grand opportunities which are open to the American. Nowhere has the former been able to project and carry out a Census involving points beyond the simple enumeration of the people, embracing a few inquiries relating to social conditions: such inquiries rarely extending beyond those necessary to learn the ages, places of birth, and occupations of the population. Such a Census, compared with the ninth and tenth Federal enumerations of the United States, appears but child's play.

Dr. Engel once said to me that he would gladly exchange the training of the Prussian Bureau of Statistics for the opportunity to accomplish what could be done in our country. For with it all, he could not carry out what might be done with comparative ease under our government. The European statistician is constantly cramped by his government; the American government is constantly forced by the people. The Parliament of Great Britain will not consent to an industrial Census, the proposition that the features of United States Census taking be incorporated in the British Census being defeated as regularly as offered. Nor does any continental power yet dare to make extensive inquiries into the condition of the people, or relative to the progress of their industries. The continental school of statisticians, therefore, is obliged to urge its government to accomplish results familiar to our people. The statistics of births, deaths, and marriages, and other purely conventional statistics, are substantially all that come to the hands of the official statisticians abroad. In this country, the popular demand for statistical information is usually far in advance of the governments, either State or Federal, and so our American statisticians have been blessed with opportunities which have given them an experience, wider in its scope, and of a far more reaching character than has attended the efforts of the continental school. Notwithstanding these opportunities which surround official statistics in this country, the need of special scientific training for men in the administration of statistical work is great indeed. This necessity I hope to show before I close.

It is not essential, in addressing an audience of this character, to spend a moment even upon definitions. The importance

of statistics must be granted : the uses of the science admitted. But it may be well, before urging specifically the needs of this country for statistical training, to give a few facts relative to such work in European schools.\*

The best school for statistical science in Europe is connected with the Prussian statistical bureau, and was established a quarter of a century ago by Dr. Ernst Engel, the late head of the bureau, probably the ablest living statistician in the old world. The seminary of this statistical bureau is a training school, for university graduates of the highest ability, in the art of administration, and in the conduct of statistical and other economic inquiries that are of interest and importance to the government. The practical work is done in connection with the government offices, among which advanced students are distributed with specific tasks. Systematic instruction is given by lectures, and by the seminary or laboratory method, under a general director. Government officers and university professors are engaged to give regular courses to these advanced students. It is considered one of the greatest student honors in Berlin for a university graduate to be admitted to the Statistical Seminary. One graduate of the Johns Hopkins University, a doctor of philosophy, is already under a course of instruction in the Prussian laboratory of political science.

The work of taking the Census of the Prussian population and resources is entrusted to educated men, many of them trained to scientific accuracy by long discipline in the Statistical Seminary, and by practical experience. (Circulars of Information, U. S. Bureau of Education. No. 1, 1887, by H. B. Adams.)

In this seminary there are practical exercises under the statistical bureau during the day time, with occasional excursions to public institutions, in addition to lectures held mostly in the evening. A recent programme of the seminary comprehends :

1. Theory, technique, and encyclopædia : once a week.
2. Statistics of population and of dwellings : once a week.

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\* President Walker, of the Institute of Technology ; Dr. Ely, of Johns Hopkins ; Prof. Smith, of Columbia College ; Dr. Dewey, of the Institute of Technology ; and Dr. E. R. L. Gould, of Washington, have very kindly placed at my disposal information supplemental to that which was at hand.

3. Medical statistics : once a week.
4. Applied mathematical statistics : once a week.
5. Agrarian statistics : once a week.
6. Exercises in political economy, finance, and financial statistics : 2 hours a week.

The students assist in the work of the statistical bureau without compensation. This is a part of their training, and by it theory and practice are most successfully combined.

I believe there are courses in statistics in nearly all the universities in Germany, certainly in the more prominent institutions of that country, but there are no distinct chairs of statistics. Statistical science is considered a part of political economy, and professors of the latter science give the instruction in statistics.

The most prominent announcements for the leading European universities, for the year 1886-7, are as follows :

University of Leipzig : Professor W. Roscher lectures on agricultural statistics, this branch being a part of one course, taking one or two hours a week. One hour a week is also given to political economy and statistical exercises by Dr. K. Walker.

University of Tübingen : Professor Gustav von Rümelin devotes three hours a week to social statistics, while Professor Lorey includes in his lectures a treatment of the statistics of forests.

University of Würzburg : Professor G. Schanz devotes four hours a week to general statistics.

University of Dorpat (a German institution in Russia) : Professor Al. v. Oettingen teaches ethical statistics two hours each week.

University of Breslau : Professor W. Lexis uses one hour a week on the statistics of population.

University of Halle : Professor Conrad has a seminary of five hours a week, in which statistical subjects, among others, are carefully treated.

University of Kiel : Professor W. Seelig devotes four hours a week to general statistics, and statistics of Germany.

University of Königsberg : Professor L. Elster lectures two hours a week on the theory of statistics.

University of Munich : Dr. Neuberg has a course of one to two hours a week on statistics.

University of Strasburg : Professor G. F. Knapp teaches the theory and practice of statistics three hours a week, and with Professor Brentano has a seminary two hours a week, in which, among other matters, they treat statistical subjects.



University of Prague: Professor Surnegg-Marburg teaches the statistics of European States three hours each week.

University of Vienna: Professor von Inama-Sternegg devotes two hours each week in a statistical seminary.

In addition to the university work outlined, much work is done in the technical schools, as, for instance, at the technical school in Vienna there are given regularly two courses of statistics:

First, "General comparative statistics of European States;" their surface; population; industries, commerce, education, etc.

Second, "Industrial statistics of European States;" methods and "technik" of industrial statistics.

These courses are given by Dr. von Brachelli, who is officially connected with the Government Bureau of Statistics.

At Dresden, Dr. Böhmert lectures at the Polytechnic on "The elements of statistics," and has a statistical seminary. Böhmert is the director of the statistical bureau in the department of the interior. Part of the instruction is given at the bureau. Courses are also given at Zurich on the elements of statistics.

Some of the more important announcements connected with the *Ecole Libre des Sciences Politiques*, of Paris, for the year 1886-7, are as follows:

1. By Professor Levasseur, the theory of statistics, and the movement of population, one hour a week for the first quarter.
2. By M. de Foville, Chief of the Bureau of Statistics, one hour a week in the second quarter upon statistics, commerce, and statistics of foreign commerce.
3. By Professor Pigeonneau, one exercise each week, in which he treats, among other subjects, of commercial statistics.

In the programme of the University of Brussels, for 1878 and 1879, an announcement for a course of political economy and statistics twice each week, by Professor A. Orts, was made.

Something is being done in Italy, but how much I am not at present able to learn.

These courses, it will be seen, are devised for the special training in the practical statistics of the countries named.

A great deal of effort has been expended in Europe through statistical congresses since 1853 to secure uniform inquiries in Census taking, and it is to be regretted that the Congresses have not accomplished the results sought. It was unfortunate that the attention of the statisticians of the world, as brought together in the congresses, was given to the form of inquiry to the exclusion of the form of presentation. In tracing the discussions and deliberations of these congresses, the absence of the intelligent treatment of the presentation of facts, even when drawn out by uniform inquiries, becomes apparent. The art of the statistician in his administrative work found but little encouragement in the long discussions on forms of inquiry, and less was accomplished by these congresses, which are not now held, than has been accomplished through training in the universities of Europe. The great statistical societies abroad have done much in stimulating statistical science, and out of these societies there has now been organized the International Statistical Institute, the first session of which was held in Rome during last month; much is to be hoped from the labors of this Institute, for the men who compose it bring both training and experience to the great task of unifying statistical inquiries and presentations, so far as leading generic facts are concerned, for the great countries comprehended under the broad term, "the civilized world." For this great array of work, the outlines of which I have briefly and imperfectly given as carried on in Europe, America has no parallel.

Our colleges are beginning to feel that they have some duty to perform, in the work of fitting men for the field of administration, and specifically in statistical science. Dr. Ely is doing something at Johns Hopkins, giving some time, in one of his courses on political economy, to the subject of statistics, explaining its theory, tracing the history of the art or science, and describing the literature of the subject. He attempts, in brief, to point out the vast importance of statistics to the student of social science and to put his student in such a position that he can practically continue his study. Johns Hopkins, as soon as circumstances will admit, will probably secure teachers of statistics and administration, in addition to its present corps of instructors.

Dr. Davis R. Dewey, of the Massachusetts Institute of Technology, is also devoting some time, in connection with his other work, to statistical science. He has two courses :

First, A course of statistics and graphic methods of illustrating statistics in which attention is chiefly given to the uses of official statistics of the United States. Students are directed to the limitations there are in this respect, what compilations have been and are made, and to the possible reconciliation of discrepancies which appear in official reports. This course is taken in connection with a course in United States finance, and the student is trained to find and use the statistics which will illustrate the points taken up, and to present them graphically.

Second, An advanced course is given in statistics of sociology, in which social, moral, and physiological statistics are considered, in short, all those facts of life which admit of mathematical determination to express the "average man." Some of Dr. Dewey's actual problems may serve to illustrate the practical work of his course. Samples of the problems which he gives to his students are as follows :

Are the Indians increasing or decreasing in numbers?

Criticize by illustrations the statement that the value of the products of manufactures of the United States in 1880 was \$5,369,325,442.

What margin of error would you allow, if called upon to test the accuracy of the returns of population under one year of age in the Federal Census returns?

Can you devise a method to determine from the Census reports on population, Table XXI., which is the healthier state, Massachusetts or Connecticut?

Is it true that Massachusetts has more crime per capita than Alabama or Georgia? Can you offer any explanation or facts modifying such a statistical conclusion? Do the Census reports afford information as to the increase or decrease in crime?

Perhaps the most systematic teaching of the science of statistics in America is given at Columbia College, under the direction of Professor Richmond M. Smith. He has lectured on the subject of statistical science in the Columbia College School of Political Science since the year 1882. His course is an advanced one for the students of the second or third year of that school. In the first year of the work there were but three students of sta-



tistical science ; at present there are about twenty-five. Professor Smith gives them lectures two hours per week through the greater part of the year. The theoretical lectures cover a brief history of statistics ; a consideration of statistical methods ; of the connection of statistical science with political and social science ; of the attempt to establish social laws from statistical induction ; the doctrine of probabilities, etc., this part of the course being based on German and French writers, principally Mayr, Engel, Wagner, Knapp, Oettingen, Quetelet, Block, and others. The practical part of the Columbia course covers the ordinary topics of statistical investigation, and the statistics are taken, as far as possible, from official publications. These latter lectures are of course comments on the tables and diagrams themselves. Wall tables are used to a certain extent, but experience has found it more convenient to lithograph the tables and diagrams, giving a copy to each student, which he can place in his note-book, and thus save the labor of copying.

From a circular of information from the Columbia College School of Political Science I find the following, relating to the teaching of statistical science :

“ *Statistical science: methods and results.* This course is intended to furnish a basis for a social science by supplementing the historical, legal, and economic knowledge already gained, by such a knowledge of social phenomena as can be gained only by statistical observation. Under the head of statistics of population are considered: race and ethnological distinctions, nationality, density, city and country, sex, age, occupation, religion, education, births, deaths, marriages, mortality tables, emigration, etc. Under economic statistics: land, production of food, raw material, labor, wages, capital, means of transportation, shipping, prices, etc. Under the head of moral statistics are considered: statistics of suicide, vice, crime of all kinds, causes of crime, condition of criminals, repression of crime, penalties and effect of penalties, etc. Finally is considered the method of statistical observations, the value of the results obtained, the doctrine of free will, and the possibility of discovering social laws.”

There may be other instances of the teaching of statistical science in American colleges, but those given are all that have come to my knowledge. At Harvard, Yale, and other institutions the theory and importance of statistics are incidentally



impressed upon the students in political economy. It will be seen, therefore, that if there is any necessity for such a course as has been cited, the necessity is being met only in slight degree.

Is there such a necessity? Speaking from experience I answer emphatically, Yes. There has not been a single day in the fourteen years that I have devoted to practical statistics that I have not felt the need, not only in myself, but in the offices where my work has been carried on, of statistical training. Trained not only in the sense of school training, but in the sense of that training which has come to our American statisticians only through experience. My great regret on this occasion is that I can only address you with the statistical bureau as my alma mater, but perhaps the lack I have seen and felt of a different alma mater may give force to my suggestions.

The problems which the statistician must solve, if they are solved at all, are pressing upon the world. Many chapters of political economy must be rewritten, for the study of political economy is now brought under the historical and comparative method and statistical science constitutes the greatest auxiliary of such a method. There is so much that is false that creeps into the popular mind, which can only be rectified through the most trustworthy statistical knowledge, that the removal of apprehension alone by it creates a necessity sufficient to command the attention of college authorities. The great questions of the day, the labor question, temperance, tariff reform, all great topics, demand the auxiliary aid of scientific statistics, and a thorough training is essential for their proper use. But in the first place there should be a clear understanding of what is necessary to be taught. We read many chapters on the theory and practice of statistics. What is the theory of statistics? The use of the word *theory*, in connection with statistical science, is to my mind unfortunate, for the word *theory*, when used in connection with positive information, antagonizes the public mind. When you speak of the theory of statistics, the word *theory* meaning speculation, the popular feeling is that theoretical statistics are not wanted, but facts. Theory may be fact; statistics may substantiate theory or controvert it. All this we know, and yet I feel that the word is used unfortunately in this connection. If I under-



stand it correctly, the theory of statistics is simply a statement of what it is desired to accomplish by statistics.

Every branch of social science desires to explain the facts of human life. There are some facts which can be explained only by statistics. For instance, it is asserted that there is an alarming amount of illiteracy in Massachusetts. Statistical inquiry shows that by far the greater number of these illiterates are of foreign birth, so that the fault is not with the public school system, but the evil is due to a temporary cause, namely, immigration.

Again, it has been freely asserted that in the United States women of native birth do not have as many children as women of foreign birth, and that thereby the real American population is steadily losing ground. The Census of Massachusetts will show that although American women do have a less number of children, on the average, yet a larger number survive, so that the alarm is needless. Common observation would never have shown these things, or would not have shown them accurately.

So everywhere statistics attempt to explain the facts of human life, which can be explained in no other way, as for instance, the effect of scarcity of food on births, on marriages, or crime; the effect of marriage laws on the frequency of divorce, etc. The theory of statistics points out where the statistical method is applicable, and what it can and cannot accomplish. In my opinion, however, it would be better to avoid the use of the word theory entirely, and adopt a concrete term like statistical science, which has three branches: collection, presentation, and analysis. Statistics is a science in its nature, and practical in its working.

The science of statistics, practically considered, comprehends the gathering of original data in the most complete and accurate manner; the tabulation of the information gathered by the most approved methods, and the presentation of the results in compact and easily understood tables, with the necessary text explanations. It is the application of statistics which gives them their chief popular value, and this application may, therefore, legitimately be called a part of the science of statistics. The theoretical statistician is satisfied if his truth is the result of statistical investigation, or if his theory is sustained.



The practical statistician is only satisfied when the absolute truth is shown, or, if this is impossible, when the nearest approximation to it is reached. But the belief that theory must be sustained by the statistics collected, or else the statistics be condemned, is an idea which gets into the popular mind when the expression, theory of statistics, is used. I would, therefore, avoid it, and I hope that should our colleges adopt courses in statistical science, they will agree upon a nomenclature which shall be expressive, easily understood, and comprehensive in its nature.

The necessity of the study of statistical science would not be so thoroughly apparent if the science was confined to the simple enumeration and presentation of things, or primitive facts, like the number of the people; to tables showing crops, exports, imports, immigration, quantities, values, valuation, and such elementary statements, involving only the skill of the arithmetician to present and deal with them. The moment the combinations essential for comparison are made, there is needed something beyond the arithmetician, for with the production of averages, percentages, and ratios, for securing correct results, there must come in play mathematical genius, and a genius in the exercise of which there should be discernible no influence from preconceived ideas. The science of statistics has been handled too often without statistical science, and without the skill of the mathematician. Many illustrations of this point involving the statistics of this country could be given.

In collating statistics relating to the cost of production, the best mathematical skill is essential, even the skill which would employ algebraic formulæ. So with relation to statistics of capital invested in production. To illustrate, the question may be asked, what elements of capital are involved in the Census question of "capital invested"? Is it simply the cash capital invested by the concern under consideration, or is it all the money which is used to produce a given quantity of goods? If the members of a firm contribute the sum of \$10,000, and they have a line of discounts of \$100,000, the avails of which are used in producing \$200,000 worth of completed goods, what is the capital invested? What is the capital invested which should be returned in the Census? If a man has \$5,000 invested in his business as a manufacturer, and he buys his goods

on 90 days, or four months, and sells for cash, or 30 days, what is his capital invested? This question is one among many of the practical problems that arise in a statistical bureau but which has not yet been treated scientifically. What has been the result of the reported statistics relating to capital invested? Simply that calculations, deductions, and arguments based on such statistics have been, and are, vicious, and will be until all the elements involved in the term are scientifically classified. Another illustration in point arises in connection with the presentation of divorce statistics, especially when it is desired to compare such statistics with marriages, or to make comparisons to show the progress, or the movement of divorces. Shall the number of divorces be compared with the number of marriages celebrated in the year in which the divorces are granted, or with the population, or with the number of married couples living at the time? I need not multiply illustrations. The lies of statistics are unscientific lies.

The conditions of this country necessitate knowledge as to the parent nativity of the population, features not included in any foreign Census, and need not be. Such features lead to what may be called correlated statistics; for instance, where there are presented three or more facts relating to each person in the population, the facts being co-ordinate in their nature. In this class of work skill beyond that which belongs to the simple operations in arithmetic becomes necessary. There must be employed some knowledge of statistical science beyond elementary statistical tables, or the correlations will be faulty, all the conclusions drawn from them false, and harm done to the public. While the scientific statistician does not care to reach conclusions from insufficient data, he much less desires to be misled by the unscientific use of correct data, or from data the presentation of which has been burdened with disturbing causes. The analytical work of statistical science demands the mathematical man. While this is true, it is also true that the man who casts a schedule (for instance, to comprehend the various economic facts associated with production), should have the ability to analyze the tabulated results of the answers to the inquiries borne upon the schedule. In other words, the man who casts the schedule should not only be able to foresee the work of the enumerator, or the gatherer of the answers



desired, but he should foresee the actual form in which the completed facts should be presented. Furthermore, he should foresee the analysis which such facts stimulate and not only foresee the detail, but foresee in a comprehensive way the whole superstructure which grows from the foundation laid in the schedule. He should comprehend his completed report before he gathers the needed information.

How can these elements in one's statistical education be secured? The difficulties in the way of the best statistical work are not slight. Dr. Dewey, in a recent address upon average prices, before the American Statistical Association, gave an exceedingly valuable, and a very clear explanation of the difficulties which underlie all efforts to secure average prices ranging over a period of years; he pointed out the different methods of securing such averages, and I can do no better than to use Dr. Dewey's own words, as taken from the address referred to. He says:

"There is first the ordinary 'index method' introduced by Mr. Newmarch, and continued by the Economist and Mr. Jevons. In this there is no attempt to take account of the varying importance of the commodities where prices are averaged together, but equal consideration is given to all.

"A second method is to give each commodity, where price enters into the averages, a weight proportionate to the quantity of it sold during a fixed period of time.

"In the third method account is taken of the varying importance of the commodities by regarding the part each plays in the *exports and imports* of a country. This system has been used by Messrs. Giffen and Mulhall. Mr. Giffen's process in detail is to find the average value of the different articles in the exports and imports; combine these in the proportions of the different articles to the totals of the exports and imports, and then reduce the totals for a series of years to the values they would have been equivalent to had prices remained unchanged."

This simply indicates that no statistician has yet arrived at a method for securing average prices that shall be considered absolutely correct; that is, in other words, the science of average prices has not been reached, because, if it had been, there would be but one method of securing them. There is but one multiplication table; all men agree to it, because every



part of it has been demonstrated to be true. The principle of the multiplication table in statistical operations indicates that science triumphs, for no scientific conclusion is reached so long as skilled men, men of experience and of training, differ relative to methods or results.

The teaching of statistical science in our colleges involves three grand divisions :

1. The basis of statistical science, or, as it has been generally termed in college work, the theory of statistics.
2. The practice of statistics, which involves the preparation of inquiries, the collection and examination of the information sought, and the tabulation and presentation of results.
3. The analytical treatment of the results secured.

These three general elements become more important as the science of statistics becomes more developed ; that is, while in conventional statistics, or official statistics if you prefer, meaning those which result from continuous entry of the facts connected with routine transactions, like custom house operations, the registration of births, deaths, and marriages, etc., these three elements may not be apparent. But when considered as regards the collection of information from original sources by special investigation through the Census, through our bureaus of statistics of labor and kindred offices, and through the consular service, these three grand elements assume a vast importance, and statistical science demands that men be employed who comprehend thoroughly and clearly all the features of the three elements of the science, for the variety of facts to be collected suggests the variety of features connected with the work.

Last year I had the honor to address the American Social Science Association upon popular instruction in social science, advocating the teaching in the public schools of the elementary principles of social science, comprehending those things which are most essential in the conduct of life, in the preservation of health, and in the securing of good order. The Association discussed the practicability of teaching social science in our higher institutions of learning. The suggestion that the school and the college be utilized for propagating the science was met with but one objection of any moment. This objection

was that in the colleges and schools the whole time is now exhausted in teaching the branches of human knowledge already established as a part of the curricula of such schools; an excellent objection from a narrow point of view, but a thoroughly inadmissible objection from a point of view which takes in the development of the human race on the best basis, and on a high standard. It was met by the counter-statement that if there is no time in the ordinary college to teach all that the college now teaches, and devote a few hours per week to social science, and all that social science means, so far as teaching is concerned, then drop something else and introduce the social science. But nothing need be dropped in order to teach social science in the colleges and schools of the country. Now, the only objection which I anticipate to the teaching of statistics in our colleges is the same that was made to the proposition to teach social science generally in such institutions, that there is no room for the introduction of instruction in the new science. To my own mind this objection is not only trivial, but of no account whatever in the practical working of institutions of learning. Every well appointed college has its chair of political economy, and this department can be broadened sufficiently to take in statistical science, without impairing efficiency in this or any other department. If this cannot be done, then I would say to the colleges of America that the institutions which soonest grasp the progressive educational work of the day will be the most successful competitors in the race. That college which comprehends that it is essential to fit men for the best administrative duties, not only in government, but in the great business enterprises which demand leaders of as high quality as those essential for a chief magistrate, will receive the patronage, the commendation, and the gratitude of the public. The college or the university which comprehends the demand of the day and institutes new forms of degrees to be conferred upon the men and women specially qualified in special science is in the van. Why should there not be a degree for sanitary science? Why should there not be a degree for social science? Doctor of Philosophy is not enough; it means nothing in popular estimation. The Doctor of Philosophy must understand various things; must be taught and thoroughly trained in the branches necessary to

secure the degree of Doctor of Philosophy, but he may know nothing of other branches of human knowledge, except in the most incidental way, which are so essential to fit him for the best administrative duties. The organization of industry demands the very highest type of mind. I sometimes think that the great industrial chieftains of the world are far superior in their capacity, and in their general comprehensive ability, to the great statesmen, to the great leaders of politics, and the great lights that carry nations through crises even. The men who are the best trained, who have learned the practical work of special sciences, are the ones that are guiding the people, and so the colleges or the universities which grasp these things, introducing the teaching of statistical science along with all the other great features of social science, including the branches which bring knowledge nearest to the community itself, are the colleges which will secure success; and not only success in a pecuniary point of view, but success in that grander field of the best work for the race. I urge, therefore, that our American colleges follow the example of European institutions. I would urge upon the government of the United States, and upon the government of the States, the necessity of providing by law for the admission of students that have taken scientific courses in statistics as honorary attachés of, or clerks to be employed in the practical work of, statistical offices. This is easily done without expenditure by the government, but with the very best economic results.

We take a Census in the United States every ten years, but as a rule the men that are brought into the work know nothing of statistics: they should be trained in the very elementary work of Census taking and of statistical science. How much more economical for the government to keep its experienced statisticians busily employed in the interim of Census taking, even if they do no more than study forms, methods, and analyses, connected with the presentation of the facts of the preceding Census. Money would be saved, results would be more thoroughly appreciated, and problems would be solved.

Our State and Federal governments should be vitally interested in the elevation of statistical work to scientific proportions; for the necessary outcome of the application of civil



service principles to the conduct of all governmental affairs lies in this, that as the affairs of the people become more and more the subjects of legislative regulation or control, the necessity for the most accurate information relating to such affairs and for the scientific use of such information increases.

The extension of civil service principles must become greater and greater, and the varied demands which will be created by their growth logically become more exacting, so that the possibilities within the application of such principles are therefore not ideal, but practical in their nature. And these potentialities in the near future will enhance the value of the services of trained statisticians.

The consular and diplomatic service, as well as other fields of government administration, come under this same necessity. The utilization of the consular service for original investigations creates in itself a wide reaching statistical force, and one which should be competent to exercise its statistical functions with all the accuracy that belongs to science. So government should supplement college training with practical administrative instruction, acquired through positive service in its own departments.

This appeal that statistical science be taught in our colleges comes to this Association more forcibly than to any other. The beginning which has been made in this direction in this country is honorable indeed. Shall it be supplemented in the great universities and leading colleges of America? Do not think for a moment that if the teaching of statistical science be incorporated in our college courses the country will be flooded with a body of statisticians. There is enough work for every man who understands statistical science. He need not be employed by government. The most brilliant achievements of the European statisticians have been secured in a private or semi-official way. The demand will equal the supply, and the demand of the public for statistical knowledge grows more and more positive, and the supply should equal the demand.

General Walker in a letter in 1874 said: "The country is hungry for information: everything of a statistical character, or even of a statistical appearance, is taken up with an eagerness that is almost pathetic; the community have not yet

learned to be half skeptical and critical enough in respect to such statements." He can add, Statistics are now taken up with an eagerness that is serious.

"Know thyself" applies to nations as well as to men; and that nation which neglects to study its own conditions, or fears to study its own conditions in the most searching and critical manner, must fall into retrogression. If there is an evil, let the statistician search it out; by searching it out and carefully analyzing statistics, he may be able to solve the problem. If there is a condition that is wrong, let the statistician bring his figures to bear upon it, only be sure that the statistician employed cares more for the truth than he does for sustaining any preconceived idea of what the solution should be. A statistician should not be an advocate, for he cannot work scientifically if he is working to an end. He must be ready to accept the results of his study, whether they suit his doctrine or not. The colleges in this connection have an important duty to perform, for they can aid in ridding the public of the statistical mechanic, the man who builds tables to order to prove a desired result. These men have lowered the standard of statistical science by the empirical use of its forces.

The statistician writes history. He writes it in the most concrete form in which history can be written, for he shows on tablets all that makes up the Commonwealth; the population with its varied composition; the manifold activities which move it to advancement; the industries, the wealth, the means for learning and culture, the evils that exist, the prosperity that attends, and all the vast proportions of the comely structure we call State. Statistical science does not use the perishable methods which convey to posterity as much of the vanity of the people, as of the reality which makes the Commonwealth of today, but the picture is set in cold, enduring, Arabic characters, which will survive through the centuries, unchanged and unchangeable by time, by accident, or by decay. It uses symbols which have unlocked to us the growth of the periods which make up our past—they are the fitting and never changing symbols by which to tell the story of our present state, that when the age we live in becomes the past of successive generations of men, the story and the picture shall be found to exist

in all the just proportions in which it was set, with no glowing sentences to charm the actual, and install in its place the ideal ; with no fading colors to deceive and lead to imaginative reproduction, but symbols set in dies as unvarying and as truthful in the future as in the past. The statistician chooses a quiet and may be an unlovely setting, but he knows it will endure through all time.







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