known as the quantum. In one of his very last papers published in January, 1912, in the *Journal de Physique,* Poincaré submits the theory of quanta to a searching examination and as a conclusion announces that it is impossible to arrive at Planck's law except under the assumption that resonators can acquire or lose energy only in discontinuous amounts. If this is true we have an extraordinary departure from received ideas and it will be necessary to suppose that natural phenomena do not obey differential equations.

Enough has been said to show the extraordinary variety of the subjects treated by this commanding intellect in the subject of mathematical physics alone. In repeating what I stated at the outset that the striking quality displayed by Poincaré is his extraordinary skill in analysis, I do not mean for a moment to imply anything against his intense receptivity for all physical ideas, for which he had a very great penetration. It is true that he sometimes met severe criticism from physicists. In particular Professor Tait made a bitter attack on his treatise on thermodynamics, but in my opinion Poincaré was well able to defend himself. It has sometimes been doubted whether he thoroughly appreciated Maxwell's ideas as to the theory of electricity, but this is of small moment, seeing that he so well understood their consequences. It must be said that Poincaré was not one who contributed fundamental new ideas to our stock of physical conceptions, such as the ideas put forth by Carnot, Kelvin, Maxwell, Lorentz with his principle of local time or Planck with his quanta.

I may in conclusion be permitted to state my opinion that the best persons to appoint to chairs of mathematical physics and those most likely to enrich our conceptions are those who have themselves had experience in dealing with nature with their own hands in the laboratory, and who may be expected to have more feeling for her modes of action than skill in analysis. Thus I believe Helmholtz, Kelvin, Maxwell, and Lord Rayleigh to have been more important contributors to mathematical physics than Poincaré, but this is not to say that the latter was not an intellect of superlative greatness.

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UNIVERSITY ORGANIZATION[1]

This subject has become in recent years one of intense interest. In most utterances on the subject the prominent feature is the statement that our universities are undemocratic, that they are monarchical institutions in a democratic country. This criticism takes various forms. When a university president speaks, the shortcomings of the university are due to the fact that the governing board are ignorant, shallow-minded, arrogant and headstrong; that they insist upon deciding matters beyond their knowledge and will not be guided by the president. When a university professor speaks it is the university presidency which is at fault. Autocracy, blindness, willfulness, prejudice, partiality, lofty-mindedness, oratorical ability, money-getting talents, piety and many other virtues and vices are ascribed to our presidents, but in the minds of nearly all writers the presidency is an unsatisfactory tool. When an outsider speaks, both president and governing board are parts of a vicious organization.

Let us grant that there is much truth in this. Boards may be unwise; the presidency may be unequal to its responsibili-

[1] With especial reference to state universities. An address delivered before a body of university men at Minneapolis, November 10, 1913.

ties and opportunities. Yet there is a third point of view, a more fundamental consideration. In the American university, as in the Russian political system, the chief difficulty is not with the autocrat, but with the bureaucrat. In my opinion, we can not go much farther astray than baldly to lay the shortcomings of our universities upon the president. As for the presidency, it is part of a great system; the president is the unfortunate occupant of an office.

Let us see how the matter stands. Any large institution such as one of our universities, in order to be successful, must have general aims or policies, must have an organization to carry them out, and must secure at once the successful operation of each of its subdivisions in its own sphere and the cooperation of each of these in the larger ends of the whole. The president is given, nominally at least, the responsibility of directing this organization in general and the right, when necessity arises, to intervene in the conduct of any of the parts in order to make them efficient and to adjust their relations with the remainder of the institution. Can any president do this under present conditions?

To bring about efficient work for desirable ends in any large institution certain things are necessary. First, a knowledge of what are the desirable aims or ideals for that institution and of how these ideals should be adjusted to the conditions of human life and to the life of the particular community from time to time. Second, a knowledge on the part of the executive of the workings of all parts of the institution and of the abilities of each member of the staff. Third, the possession of actual power by the executive to secure the cooperation of all parts in whatever is for the common welfare. This is true no matter whether the common welfare is found in the closest centralization or in the greatest freedom of individual action, no matter whether the executive is a president or a committee or takes some other form. Our universities must be organized, must have common ends and must exercise executive power, if the only end of that power be to secure anarchy. It is my purpose to inquire what is wrong with the present organization, that our universities should work so badly and that individuals should suffer so in the process.

Where does a university get its ideals or policies? Necessarily, they become the possession of the institution through the expression of ideas or opinions by members of the faculty and student body and through the accumulation of such ideas in the form known as traditions. Individuals in the university, whether president, instructors or students, necessarily furnish the ideas out of which common aims are constructed and in accordance with which old aims are adjusted to new conditions. Is there at the present time any adequate means by which the ideas of individuals can be made available for the common good? Two illustrations will answer the question in part. The head of a university department called together his entire staff including student assistants to discuss the organization of teaching with a view to improving the arrangement and content of the courses of study. The whole matter was discussed at two successive meetings, the professors talking over various plans without coming to any satisfactory conclusion. Instructors and assistants had been asked to think over the matter and at the second meeting each one in turn was called upon for suggestions. One assistant had a plan entirely different from anything that had been suggested. He outlined it and showed how it would improve the teaching and bring about a better correlation in

the work of the department. The men of professorial rank criticized the plan severely and the young man was made to feel that he was presumptuous in proportion as his plan was chimerical. After a rather long interval a third meeting was called. The head of the department announced that a plan had been devised, and proceeded to outline the identical plan which had been proposed by the assistant. It remained in effect for several years. Absolutely no hint of credit or recognition was ever given to the young man. Again, an instructor arose in general faculty meeting in an arts college in a state university and discussed a pending question at some length and with much cogency. His friends were filled with apprehension and one of them finally succeeded in signalling to the speaker to desist. He was afterwards informed by the dean that men below the rank of assistant professor were not expected to debate questions in the faculty. Instances might be multiplied to show that great difficulties stand in the way of the ideas of young men finding expression or receiving consideration in our universities. It is a well-known fact that in many departments the young men never know what plans are afoot until their duties are assigned them. And yet the young men are the only ones who can offer any new ideas to their institutions. Let it not be thought that the writer has any personal interest in this aspect of the question. He has passed the time when he can expect to produce any *new* ideas. Whatever new ideas he might have contributed to the universities with which he has been connected are lost forever,—unless indeed, ear is still given to what he might have said years ago. Of course, that is precisely what our mode of organization means. The university forbids a young man to speak until he becomes a professor. Then if he has not forgotten the ideas which came to him in the days of his youth and enthusiasm, or if the time for their application has not long gone by, the institution is willing to listen to him. That ensures conservatism,—but not progress. It means that the university never adjusts its ideals to the times but is forever denying itself the information which its individual members could supply.

If the university is slow and inefficient in securing information as to what should be its aims and policies, what about the sources of information for the executive as to how those policies are being carried out? The president depends for his information first upon the deans of colleges and schools, and second, upon the heads of departments. He depends upon these men also for executive functions under his direction. The president must depend upon these men for information, since he can not by any possibility know all the details by his own observation. Neither can he go personally to all individuals for information. In general the president is equally under the necessity of following the advice of his heads of departments, since otherwise he would lose their confidence and his only source of information. The president instead of being the autocratic monster that he is depicted, is in an almost pitiable situation. Unless he be a man of altogether extraordinary energy and strength of purpose, he is wholly at the mercy of his heads of departments. So far as the heads of departments are honest, wise and possessed of ideals for the common good the president is fortunate, and nothing that I may say in this talk can be construed as a criticism of such men. But heads of departments are endowed with human nature, and it is well known that they exhibit it in the conduct of their departments.

In one case a department of chemistry

was equipped with a great amount of expensive glassware and analytical apparatus of which the head of the department did not know the uses, while the students' tables were almost devoid of ordinary reagent bottles. The younger men in the department were unable for a long time to secure the ordinary equipment needed. In other cases men who were drawing full professors' salaries have taken their time for outside professional work or for dealing in real estate, coal or gas, neglecting their teaching and imposing extra work on the instructors to the detriment of both instructors and students. A head of department may carry on for years policies which are not approved by a single member of his staff; may absent himself from all teaching whatever; may neglect to do any research work or contribute anything to the advancement of his science; may pursue constantly a policy of selfish material aggrandizement for which the department suffers both in the esteem of the university and in the decrease of scientific work which the members of staff can do; may deliberately sacrifice the interests of the students to his personal ambitions, and may in these ways cause constant friction and great waste of energy throughout the college—all this while maintaining a pretense, or even a belief, that he is a most public-spirited and useful member of the faculty. The head may conduct his department in such a way as to make research impossible and even drive men out of his department because they do research, all the while that he himself talks of the importance of research. Heads may appoint to high positions men who have given no evidence whatever of their qualifications for the work proposed. Heads of departments and deans have been known to use their offices to secure advancement for their personal friends and are able to sidetrack valuable proposals for the common good which threaten to compete with their own interests.

The head of a department enjoys a remarkable liberty in the conduct of his department and in the performance of his individual duties. He may suppress the individualism of his staff members, ignore any suggestions which they may make, and dismiss them if they insist upon their ideas. He may falsify the reports as to the teaching and other work done by himself and by members of his staff. If subordinate members of the staff have different ideas as to the conduct of the departments they are vigorously overruled by the head, and if any question of bad policy or of injustice is brought to the stage of investigation by the president, that officer is governed by the principle that all matters of testimony must be construed by him in a light as favorable as possible to the head of the department. The president is bound to do this because he is dependent upon his heads of departments for information, advice and executive assistance. The "heads of departments" thus become a *system* which involves the president and from the toils of which he can not easily extricate himself. It is a matter of common knowledge that in some departments no member of staff is asked for his opinions or is encouraged to hold or express independent views, that younger members of the faculty commonly dare not express themselves publicly or go to the president or dean in matters in which they differ from the heads of their departments, and that generally the department head assumes that the decision of any question resides with the "responsible head," regardless of the views of his subordinates. There is no way in which the members of staff can influence the policy of their department, there is no chan-

nel by which the facts can be brought effectively to the notice of the president or governing board, and there is no assurance in our present form of organization that the welfare of the staff or their opinions as to the welfare of the university, would receive consideration if opposed to the desires of the department head. All this is expressed in common university parlance by saying that the head regards the department as his personal property and the members of staff as his hired men.

I believe that a truer statement of the case is this. Some years ago each subject was taught by a single professor. The growth in the number of students made it necessary to appoint new instructors to assist the professor. At first these assistants were very subordinate in years and experience and it was only natural that the responsibility for the work of the department should remain with the professor. With further growth of the institution the department staff has come to include several instructors and professors, each of whom has a primary interest and responsibility in the welfare of the department and of the institution. Instead of this being recognized, the full powers of the department have been left in the hands of the original head. These heads have in consequence come into control of the sources of information to the executive, have jealously guarded their great powers, and are able to direct departmental and university policies through holding the president in ignorance and their subordinates in contempt. In other words, university control has come to be vested in a system of *ir*responsible heads of departments. This was what was meant in the beginning by saying that the difficulty lies not with the autocrat, but with the bureaucrat. More than one well-meaning university president has recognized the situation, admitted his powerlessness at critical periods and has sought to extricate himself and his university by having recourse to private interviews and by the appointment of advisory committees.

If the only evils of this system were that it entails upon the president great difficulties of university management and results in the misdirection of department affairs and the waste of material resources, it would not be so intolerable. Its more serious effects are that it lowers the efficiency and the moral and spiritual tone of the whole institution, that it wastes the time and energy of whole staffs in order that the head may take his ease or satisfy his ambitions. Moreover, taking away from faculty members the responsibility for the conception and execution of university policies is the best possible way to break down the practical efficiency of these men and to reduce the college professor by a process of natural selection to the impractical, inexperienced hireling that he is popularly supposed to be. Whether this is in part the cause of the wretched teaching which is done in our universities and of the lack of standards of work and of character for the student, I leave you to judge.

There is a second unfortunate feature in our university organization to which I will give only brief attention. This is the prominence of the colleges and schools and the sharp boundaries between them. The colleges are not based upon any natural subdivision of knowledge, but upon practical or technical grounds. Each college has in view the esteem of its own profession and has little sympathy with other colleges which make up the university. The very existence of the colleges creates special interests and produces strife which is in no way related to the welfare of the student or the general public. Teaching

and equipment—apparatus, supplies, library—are duplicated, the natural relations of fields of knowledge are subordinated to the practical application of specific facts and laws, college walls and college interests intervene to prevent the student from following co-related subjects in which he is interested, professional interests and professional ideals begin early to narrow the student's vision and to substitute professional tradition and practise for sound judgment and an open mind. All this is unfortunate. The professions should foster but not confine their apprentices. A student preparing for professional work should have the advantage of the traditions and practises prevailing in the profession, but those traditions and practices should not constitute limitations on his opportunities, his enterprise or his initiative.

A third evil tendency in our universities is the growing complexity of administrative organization. Good results can not be secured by relying chiefly on a system of checks and safeguards. These can not replace capability, honesty and a genuine interest in the university's welfare. Checks and safeguards can at best only prevent some abuses, while they certainly place obstacles in the way of men who would do honest work. It is of doubtful value to set a sheep dog to keep cats from killing young chickens—especially when the main business of the university is not to raise either sheep or chickens but to rear *men*. There is a constant danger that good men will be obliged to kotow to administrative officials who ought to be servants but who proclaim themselves masters. To appoint capable men and to place confidence in their concordant judgment would at once prevent the abuses and secure the desirable ends.

FUNDAMENTAL PRINCIPLES UPON WHICH UNIVERSITY ORGANIZATION SHOULD REST

The functions of a university are three. First, to bring together teachers and students under such conditions that the whole field of knowledge is opened to the student and he is offered competent and reliable advice and assistance in his studies. The second function arises from the responsibility for the competent direction of the student's work. The university must examine the foundations of its authority by making original investigations to test, correct and enlarge the existing body of knowledge. No institution which neglects to prosecute research in as many fields as practical conditions permit, is worthy of the name of university. The third function of a university is to make its store of knowledge practically available to its community and patrons and to stimulate in the members of the community an interest in the further acquisition of knowledge.

The university is thus concerned with knowledge and its applications. University organization exists for the purpose of securing suitable conditions for research and teaching, for the acquisition and the application of knowledge. Certain of the conditions of successful work in a university may be laid down without argument. First, that each individual instructor or student should enjoy freedom and bear responsibility in his work, *i. e.*, he should be judged by his achievements. Second, the recognition of the facts that dealing with knowledge is the central function of the university; that all organization must contribute to this end; that the teacher, the student and the research worker are the sole persons of primary value in the university; that all administrative officers are accessory machinery; that all organization should spring from those primarily engaged in the

university's work; and that all authority should rest with these and with the community which supports the institution. This organic relation of the actual workers to the university government is at once a natural right and the foundation of that personal interest and enthusiasm which are necessary to successful endeavor. Note that I do not say that the instructor and research worker should be *made to feel* that he has an interest in the university organization and a part in university policies through his advice and so forth, but that the teacher and research worker is in the nature of things the actual source of authority in the university, conditioned only by the relations of the university to its community.

What, now, is the proper form of university organization, and how can it be approached in our state universities?

The governing board should represent both the community served and the university. The people of the state furnish the financial and spiritual support for the university and receive the benefits of its work. The support can be withheld whenever the returns are unsatisfactory. The interests of the people do not require to be protected by the governing board. The members of the university faculties contribute their lives, and receive in return a living wage. It is only with the greatest difficulty that they can withdraw their investment in the enterprise. They furnish also the plans of work and the expert direction. The nature of the work is such that it is essential that the staff should have a free hand in executing its plans and should be responsible to the people for its achievements. It seems clear that a governing board composed of three members appointed by the governor from the state at large, three members elected by university faculties from their own number, and the president, would at least not err on the side of giving too great autonomy to the university. It is clear that complete autonomy would carry with it the danger of losing touch with the university's constituency, while the presence of an equal representation from the university and the state would free the faculty permanently from the stigma of control by "non-scholar trustees." Those present well know, however, that boards of the existing type may show an excellent spirit and judgment.

The internal organization of the university should have reference solely to efficiency in teaching and research. The organization should be created by the members of the staff by virtue of their sovereign powers within the institution. The first natural subdivision of the university is that into departments based upon the relations of the fields of knowledge. The process of subdivision of subjects and creation of new departments has gone too far and must be reversed. Under the old order of things the only way for a man of parts to gain recognition and influence which he was capable of using, was to become the head of a department or the dean of a college. This accounts for the creation of many new departments and schools for which there was no need. Administration could be simplified, duplication of work, apparatus, books and supplies could be avoided, and a closer correlation and a better spirit and more stimulus to scholarly work could be secured by the creation of larger departments based on close relationship of subject-matter.

The staff of such large departments might number ten, twenty or more men. In the nature of things the organization within such a department is based upon the personal interest of each member of the staff in the success and welfare of the department, and its object should be to place the resources of the department in

the fullest degree at the command of the student and to facilitate research. These things can be secured only where there is harmony among the staff and where the ideas of the staff are carried out in the administration of the department. Harmony of ideals and executive representation can be secured only by the *election* both of new members of the staff and of the administrative head of the department. New members of staff should be nominated to the president by those who will be their colleagues and who are best able to judge of their fitness for their places. The president will of course actively share the responsibility of appointments. Promotions should be recommended by the chairman and approved by a university committee on promotions.

All important business should be done in staff meetings. The chairman should administer department affairs according to the decisions and by the authority of the staff and should *represent* the staff in relations with other departments. Within the department there should be the greatest practicable freedom of the individual in teaching and research, together with publicity of results. Subdivision of the field covered by the department, organization and assignment of work would be done in staff conference. Publicity regarding the number of elective students, percentage of students passed and failed, average grades given, research work accomplished, and so forth, would furnish opportunity for comparison, friendly rivalry, self-criticism and improvement of the work of each teacher. The first step toward improvement of organization of state universities would be the organization of department staffs to bear the responsibilities and to direct the work of the department through an elected chairman. The second step would be the gradual combination of smaller into larger departments.

The next important step would be the breaking down of the boundaries between colleges on the side of teaching and investigation, making each student perfectly free to study where and what he will, subject only to the regulations of departments and to the means of gaining his own ends. Some present schools and colleges would take again their proper places as departments, the others would be dissolved.

So far as the present colleges serve a useful purpose their place would be taken by faculties for the supervision of professional and degree courses. Each such faculty should be made up of representatives of all departments which may offer work toward the given degree, such representatives to act under instructions from the staffs of their respective departments. These faculties should prescribe requirements for entrance and for graduation but should have no control of finances or of appointments. They should exercise only an advisory function in regard to the election of studies or the student's use of his time. Any faculty might, if it was deemed advisable, prescribe final examinations over the whole course of study, or the presentation of a thesis, and so forth. Thus we should have an A.B. faculty, an LL.B. faculty, an M.D. faculty, and so on, each safeguarding the traditions which surround its degree or the standards which should be upheld in the profession, but each giving full opportunity to the various departments to place before the student new materials, methods and ideals; and giving to the student opportunity to try his powers and extend his acquaintance beyond the usual limits laid down by the traditions of his degree or his chosen profession. This mode of organization would also make it as easy as possible for the student to change his course in case

he found that his choice of a profession was unsuited to his individual talents.

In such an organization the university senate might have somewhat enlarged powers and more detailed duties. The administrative functions now exercised by the faculties and deans of colleges would in part vanish, in larger part be transferred to the several departmental staffs and in part devolve upon the senate either in the first instance or through reference from departments. The senate would continue to be a court of appeal in cases of dispute between faculties or departments. The establishment of new degrees or degree-courses would require action of the senate, and sweeping changes in any curriculum or the membership of any faculty should have the approval of the senate. For example, the university could not establish a new school of naval architecture or of mental healing or of colonial administration each leading to its special degree, without the sanction of a body representing the whole university. Neither could the faculty of arts radically change the character of the course leading to the A.B. degree, either by the ingestion or the extrusion of a large group of departments, without such action being subject to review by the university senate. More need not be said on this phase of the subject. It seems clear that with the greater freedom of action on the part of students and departments, with special faculties laying down regulations for the various degree-courses, with the elimination of rivalries and strife growing directly out of the organization by colleges, the problems of internal correlation and control would be greatly simplified and could readily be cared for in a senate organized very much as ours is at present.

Simplification in university work and administration is the crying need next to independence and responsibility of the members of the faculty. The endless red tape of business administration could be largely done away with by the logical completion of the budget system. The budget having been made by the governing board, each department should be perfectly free to expend its own quota of funds by vote of its staff without supervision or approval of anybody—and should be held responsible for the results secured from year to year. Nobody can know so well how money should be expended as the staff who are to use the things purchased, no one knows so well where to get things or how to get them promptly when needed, none feels so directly and keenly the effects of misuse of money, none will so carefully guard its resources as the department itself. The dangers of duplication will be set aside by the better correlation of departments already suggested. In establishing common storerooms, purchasing agents and the like, the first and chief step should be to ask of the members of the staff throughout the university, how can the administration help you in your work through such agencies as these, instead of thinking how these agencies can remove from the departments the ultimate control of their work. Time and money may be wasted at a frightful rate through fear to place responsibility and confidence where they belong—a fear which is well-founded on our present system of irresponsible heads of departments.

Simplification in the administration of teaching would be favored by the dissolution of the colleges and the setting free of the elective system under a few simple regulations as to the combination of elementary and advanced courses and of major and cognate work which would be necessary for an academic degree, and as to the prescribed curriculum in a professional course. What is needed is fewer regulations and

better teaching; fewer snap courses, fewer substitutions and special dispensations; less care for the poor student and more food for the good student; less interest in sending forth graduates and more measuring up of students against standards of honesty, industry and self-judgment.

Finally, the presidency. Shall the president be elected by the faculty? Shall his actions be subject to review by the senate? Shall he have a veto power over the senate? Shall his duties be limited to those of a gentleman, orator and representative of university culture, or to those of the business agent and manager? The discussion of these questions seems to the writer to be of minor importance. With such a governing board and such an internal organization as has been briefly outlined, it can scarcely be doubted that the president will be representative of his faculty or that he could secure intelligent action from the board. Nor would it be difficult for the president to be a leader in whatever ways he was fitted for leadership or in whatever matters leadership was required. It seems to me that the presidency should be controlled by unwritten rather than by written laws. What is essential is that the university have a strong executive; strong in the discovery and application of right principles, strong in his reliance upon the consent and the support of the governed and strong in the execution of their ideals. The remedy for our evils is not to object to a strong executive, but to remove the necessity for an arbitrary executive; not to cry out for anarchy, but to introduce self-government.

Allow me to recapitulate. Our universities are laboring under a bureaucratic form of government in which the initiative rests chiefly with the heads of departments, in which there is a constant struggle for power among the bureau heads, in which these same heads are the chief source of information and advice to the executive, in which most of the faculty have no voice in framing policies, and in which—at its worst—the student is concerned only to be counted and the public only to be milked. The extreme of degradation is reached when research is wholly neglected and teaching is regarded as only the excuse for material aggrandizement. The bad state of affairs which we see every now and then in this or that department or college in all our universities can not be regarded as the free choice of any average group of men. I can not conceive of any of these things being voted by members of a staff. These conditions are the result of the arbitrary power placed in the hands of single men without check or publicity. Such a system always breeds dishonesty and crime. The remedy is to recognize the primary interest of every member of the staff and to establish representative government in the university. On the whole and in the long run the combined judgment of the members of the staff of any department is sure to be better than that of any individual. Self-government stimulates individual initiative and calls forth ideas for the common good. The enjoyment of freedom and responsibility will make of our faculty morally strong and practically efficient men, and will call into the profession capable men, men robust in intellect and imagination, instead of the weaklings who now barter their souls for shelter from the perils of a competitive business world.

It may be true in a legal sense that the state through the board of regents now hires the members of the university faculty. But men to do university work *can not be hired.* Those of the faculties who now do university work do it not because they are paid living wages, but because they love the work. It has been one of the great fallacies of human history to suppose that workmen

can be hired. When you hire or enslave a man you secure only mechanical service. The world's work can not be done by hired muscle alone, but requires personal interest, moral character and entire manhood. Slaves survive in their pyramids, their temples and their papyri, where their masters have perished. The successful and progressive civilizations of to-day are founded on the freedom and self-satisfaction of the individual. The most acute problems of modern society arise out of the hiring of men to do work which they would much prefer to do for themselves and would do better for themselves. These things bear their lessons for universities, if we will heed them. Freedom of speech and complete self-government are necessary to the best interests of a university. A whole staff is together more capable than any one man. Suppression of staff members who speak without authority of the head is the suppression of truth and initiative. It has resulted and must result in the selection of weak men for the faculty and in narrowness, bigotry and provincialism in the institution. Self-government will draw strong men into the faculty, will stimulate initiative, will make possible and encourage progressive administration, and will bring to mental endeavor on the part of both student and teacher the freshness of the morning air, the pursuit of a goal of one's own choosing, and satisfaction in the achievement of one's ideals.

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THE FUR-SEAL CENSUS FOR 1913

In the summer of 1912, for the first time, a complete enumeration of the breeding stock of the fur-seal herd of the Pribilof Islands was made. Prior to that season estimates of the herd were based upon a full count of harems, to which an average harem, obtained by counting individual animals upon a part of the breeding ground, was applied. The rookeries counted were naturally the smaller and more scattered ones and the average harem derived from them did not fairly represent the larger rookeries. The importance of the annual estimates, however, lay in the measure of decline which they afforded, and for this purpose they were as useful as exact counts would have been.

The treaty of July 7, 1911, suspended pelagic sealing, the cause of the herd's decline, and it was natural to expect a cessation of decline and the beginning of growth toward recovery. The exact condition of the breeding stock at its lowest point became, therefore, in 1912, a consideration of the greatest importance. A count of all the breeding families, which was in effect a count of the breeding males, was easily made, but the females come and go in the sea and are never all on the land at one time. They furthermore could not be counted accurately, if they were all present, as they can not be herded or driven. Their direct enumeration, therefore, is an impracticable thing. The young pups, however, are timid of the water during the first month or six weeks of their lives and do not go into it. After the breeding season is over, that is, early in August, the mothers can be driven off and the young herded and handled like sheep. As each pup represents a mother, the problem became merely one of counting all the pups. This was accomplished and an account of the work for 1912 was given in the December 27 issue of Science.

As the census of 1912 was important to give exact information regarding the breeding stock at its lowest point, so a repetition of this census in 1913 became important to establish a measure of increase or expansion in this breeding stock. The total number of pups found in 1912 was 81,984. For the season of 1913 the total was 92,269, a gain of 12½ per cent. The normal annual gain of the herd arises from the accession of young three-year-old females coming upon the rookeries each season to bear their first pups. The theoretical rate of gain, as deduced from the quota of three-year-old males, taken in recent years,