bases and acids and life-destroying temperatures. On the contrary, the methods of physical chemistry are of such a nature as to make it possible to investigate the complete structure of many unstable substances of the organism, *in statu quo*, without modifying the changeable equilibrium of the often highly complex systems. This will insure to physical chemistry for an unlimited time to come a very important, and, I dare say, together with structural chemistry, a leading place in the medical sciences.

Far be it from me to underestimate the great achievements of other auxiliary sciences and methods of investigation in medical research. However, they can not lead us as far as does chemistry.

Let us, for example, consider the investigation of electric currents initiated by some physiological processes. No one, certainly, would maintain that the registration of these currents is the final aim of their investigation, even if this were done with faultless technique. Rather would not the question be raised, what chemical processes underlie the curves received by registration? Likewise, it is chemistry which we must expect to help us gain a deeper insight into the nature of and laws governing the processes of gland secretion.

Adapting an utterance of Mach, we may say: "The problems of nature resemble a manifoldly knotted thread, the course of which we can follow now from this and then from another loop which attracts our attention." There is no doubt that in future even more than now physical chemistry will furnish us the loop in our effort to disentangle many an intricate problem.

And the names of Hugo de Vries, Van't Hoff and Arrhenius will forever have a place of honor in the history of medical sciences.

H. J. HAMBURGER

GRONINGEN

THE COLLEGE MAN IN THE PUBLIC SERVICE

WITH the growth and development of the higher institutions of learning in the United States, the Federal service is attracting and securing an ever-increasing number of college-trained men. The civil-service act of 1883, providing for the gradual application of the competitive-examination method of selecting public officers and employees, opened the door of opportunity in the executive civil service to those whose merit appears from personal demonstration without reference to political affiliation.

With a better qualified personnel, measuring up to higher standards and guided by nobler ideals, there has been a marked increase in efficiency with greater dignity of service as a natural corollary. This marks the triumph of useful knowledge and discipline acquired in schools and colleges, a reminder that "wisdom is justified of her children" in the time and money spent in the cause of education.

It is hardly necessary to observe that the proper performance of the duties of a large number of employments in the public service does not require collegiate training. The lower grades are generally filled by those who have acquired at least the rudiments of education ordinarily obtained in the public schools, and not a few positions are filled by those who have had the advantages of training in special courses for skilled occupations.

Broadly stated, the largest sphere of usefulness in the public service for the college-trained man is found in the military, administrative, and technical offices of the executive branch of the federal government, as well as in legislative and judicial offices.

Positions in the military service, being filled principally by graduates of the government collegiate institutions at West Point and Annapolis, offer careers to comparatively few graduates of other schools. However, there are opportunities for appointment to some places in the military and naval services through competitive examinations held by the respective departments. Among these may be

mentioned positions in the medical corps of the army and of the navy, civil engineers in the engineer corps of the army, assistant naval constructors in the navy, second lieutenants in the army and in the marine corps. The war department has at the present time about one hundred and fifty vacancies in the cavalry, field artillery, and infantry branches of the army that are to be filled from civil life after preference has been given to enlisted men capable of passing the tests required for promotion from the ranks. To secure nomination for a commission in the army a civilian must pass (1) a preliminary mental examination, (2) a physical test, and (3) a final mental examination. Graduates of "recognized" colleges or universities or of institutions of learning at which officers of the army are detailed as professors of military science and tactics of a certain standard, are not required to take the preliminary mental test, and upon passing the physical test and the final mental examination "honor" graduates of such institutions receive preference in appointment. An examination is now in course of preparation by the war department to fill from civil life ten places of civil engineer in the engineer corps of the army. The United States Public Health and Marine Hospital Service offers a career to graduates in medicine who can pass the examination prescribed by the service. The diplomatic and consular services have recently been placed, by act of congress and executive order, on a higher plane and made more permanent in character. Entrance to either service is through examination, and vacancies in the more important posts are filled by those who demonstrate ability in the lower-salaried offices. The entrance examination is searching and includes collegiate work. All appointees to these positions in the various services mentioned are commissioned by the President of the United States.

Public confidence in the worth of college training is seen in the choice, through the elective franchise, of members of congress, of whom nearly one half are college graduates. What was said upon this subject some years ago by Dr. Garfield, then of Princeton University, can be said with even greater truth to-day: "The educated man has no better claim on the suffrages of the people than the uneducated, so long as there are both trained and untrained bodies of men in the community, for this is government by the people; but the educated man, exercising his power as a creator of sound public opinion, occupies a position from which he can not be driven by the machinations of the politician and to which men of purely practical political experience can not be appointed or elected." It is scarcely necessary to add that a majority of the justices and judges in the federal judiciary are men of collegiate training.

Owing to the number and variety of administrative and technical offices in the executive branch of the public service, the university-trained man has a wide field for selection, and the high degree of ability or technical training required offers careers in the civil service often more purely professional and not less dignified or useful, even though sometimes inadequately compensated, than a legislative, judicial or military career.

With respect to administrative officers, including secretaries and assistant secretaries of departments, commissioners, heads of bureaus, and other subordinate officers, men with college training are usually selected for appointment. Promotion of meritorious subordinate officials to administrative offices is not by any means so rare nowadays as it was in former years. There are hundreds of civil administrative officials who, having entered the service in subordinate capacities and demonstrated their ability, have been advanced to more responsible positions on their record. The recognition of merit creates a healthy ambition on the part of subordinates to excel in the performance of their duties and thus to win promotion.

It is in the field of applied science, however, that the demand for university training is imperative and where the personnel of the service is almost wholly composed of college men. Washington is not only the seat of government but also the abode of learning,

especially that learning which is acquired by research and original investigation. Of two thousand leading scientific men mentioned in "American Men of Science," by Professor Cattell, two hundred and twenty, or eleven per cent., reside in Washington, a percentage exceeded only in the states of Massachusetts and New York. President Jordan, of Stanford University, himself formerly engaged by the United States for scientific work, in an article on the establishment of a national university, says: "The scholars and investigators now maintained at Washington exert an influence far beyond that of their official position." A very large body of university-trained men in Washington are devoting themselves to study and experimentation, endeavoring to gain concrete knowledge that may be applied to the development of the country's resources. A writer in *The Outlook* of July 24, 1909, upon the subject, "Patriots in the Public Service," paid a graceful and well deserved tribute to the ability and patriotic devotion of the scientists who labor in the federal service. "There is no class of men," he says, "who contribute so directly and on so large a scale to the welfare, progress and wealth of the whole people as do the scientists of the federal government. This is due to their exceptional ability, to their *esprit de corps,* the watchword of which is disinterested service, and to the position of vantage and influence which their official status gives them."

Governmental activity along lines of applied science has reached huge proportions. Thousands of scientists, scores of laboratories and an annual expenditure of a hundred million dollars but inadequately express the magnitude of governmental enterprise in this direction. The current appropriations for the Department of Agriculture alone are over twenty millions of dollars, and investigation is going on in every field where systematized knowledge can aid in the conservation of resources, in the multiplication of products, or in the solution of economic problems of the rural community.

Some of the activities of bureaus of the Department of Agriculture are indicated in the following:[1]

Weather Bureau: meteorology.

Bureau of Animal Industry: pathology, zoology, biochemistry.

Bureau of Plant Industry: plant physiology and pathology, pomology, horticulture.

Forest Service: dendrology, silviculture, utilization of wood products.

Bureau of Chemistry: investigations and analyses of fertilizers, agricultural products, foods, drugs, etc.

Bureau of Soils: analytic, fertility and soil-water investigations.

Bureau of Entomology.

Bureau of Biological Survey.

Office of Experiment Stations: nutrition, irrigation and drainage investigations.

Office of Public Roads: chemistry, petrography, scientific road construction.

Among the bureaus and offices of other departments engaging in work of a scientific or technical character are:[1]

Treasury Department:

Public Health and Marine-Hospital Service, with its Hygienic Laboratory: medicine and surgery, chemistry, pharmacology, zoology, sanitation.

Supervising Architect's Office: employing architects, civil engineers, etc.

Bureau of the Mint: coining and assaying, involving chemistry, metallurgy, etc.

Navy Department:

Naval Observatory: astronomy and mathematics.

Hydrographic Office: hydrography and cartography.

Interior Department:

Geological Survey: geology, paleontology, chemistry.

Bureau of Mines: physics, chemistry, mining, metallurgy.

Patent Office: investigations in almost every branch of applied science.

Reclamation Service: civil engineering.

Government Hospital for the Insane: mental diseases.

[1] This abridged reference to bureaus and offices and their activities is merely suggestive and is not intended to be a complete or detailed enumeration of all bureaus and offices doing scientific or technical work, of their functions or of the sciences involved.

Department of Commerce and Labor:
Bureau of Standards: physical and chemical investigations.
Coast and Geodetic Survey: geodesy.
Bureau of Fisheries: aquatic biology and physics, oceanography, applied ichthyology, utilization of water products.
Bureaus of the Census, of Statistics and of Labor: statistics, social and economic subjects.
Lighthouse Service: civil engineering.
Smithsonian Institution and National Museum: natural sciences.
Several bureaus of the different departments are engaged in technical work involving civil, electrical and mechanical engineering.

The headquarters at Washington serve as a training school in some of the bureaus which have field services. Employees are trained in the central office before being sent out to field stations. In other bureaus employees gather material in the field during the summer months and in the winter return to Washington to prepare the material for study and publication.

If salaries of scientists and experts in the public service are in general somewhat inadequate considering the education required and the scholastic nature of the duties involved, there are compensatory advantages which must not be overlooked in comparing a career in the public service with a career in private life. The government is liberal in furnishing adequate equipment in the way of laboratories and libraries to carry on its research work. Notable libraries and laboratories are the Libraries of Congress, the Department of Agriculture, the Bureau of Education and the Surgeon General's Office in the War Department; the law libraries of the Supreme Court and the Department of Justice; the laboratories of the Bureau of Standards, the Department of Agriculture, the Bureau of Mines and the Hygienic Laboratory and the laboratory of the Army Medical Museum.

While men of exceptional attainments in special lines, employed as collaborators and experts, are often given a monetary compensation far below what they might receive in private employment, they gain the prestige following their selection by the government as recognized authorities, and, also, the opportunity to follow out, with ample assistance and equipment, various lines of investigation of great ultimate benefit to the people. Young college men, with the capacity for original work, and with a thorough foundation of theoretical knowledge, find encouragement to pursue the practical side of science.

Industrial organizations demand men trained in applied science. The government service not only offers opportunity for advancement, but is also used by private employers of technical skill as a hunting ground and source of supply. Many opportunities are given experts in the different bureaus to enter university or commercial positions, often at salaries more than double their government compensation. In consequence, resignations from the higher offices are comparatively frequent, promotions follow, and the resulting vacancy in the lowest grade is filled by appointment through competitive examination.

Many clubs and associations furnish opportunities for the exchange and diffusion of ideas. The Cosmos Club, the National Geographic Society, and the Washington Academy of Sciences may be mentioned as examples, and many branches of science have their corresponding societies. The Carnegie Institution for research, though a private foundation, has given additional importance to Washington as a center of learning. With so large a number of eminent scientists working under favorable conditions and the stimulation derived from social intercourse and exchange of thought, an unusual environment and atmosphere, at once healthful and helpful, are created and sustained.

The college man in the public service is today essential to the maintenance of efficient and economical administration, and he should enter it with as much assurance of an honorable career as do the British who enter their home or foreign services. The college man's training has been systematic; he has been taught to recognize fundamental principles; he has learned to reason, to coordinate, to concentrate all of his powers upon the subject in question. When he enters the service

his education is still incomplete, but he brings with him an ordered mind which makes easier his own path and that of his superiors, for he is quick to grasp essentials and to reach results. He outstrips his less favored brother who lacks the training and discipline of the college or university; and the fact that occasionally there are to be met splendid examples of practical intelligence and energy whose training has been obtained in the world's hard school of experience and not within academic walls does not in the least lessen the force of the contention in favor of the college-trained man's availability.

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CONCERNING BOTANICAL INVESTIGATION IN COLLEGES

DURING the last two or three years several articles have appeared in SCIENCE which have had to do wholly or in part with scientific investigation in colleges. As a college teacher the writer has read these with interest. He is just entering upon his twentieth year as a college teacher and has, during two decades of experience with college students, reached certain conclusions concerning this subject, especially in so far as it relates to his own subject—botany. It is not believed that botanical science differs greatly from other sciences with respect to investigation, but it has seemed best to the writer to confine his statements to the science which he is teaching.

Every teacher of botany should be an investigator. The spirit of investigation, which appears in the normal person in early childhood, should never be stifled in one who is to teach botany or who is teaching that science. When the teacher of botany ceases to be an investigator he should retire. His investigation should extend at least to the plant life about him and to the literature directly or indirectly relating to his teaching. Some botanists fear that this spirit of investigation will, if carried further, interfere with teaching in college. The writer pleads guilty of seeing 100,000 titles in a single year in search of matter that might aid in his teaching and in the advancement of botanical science, recording some titles for future use, and examining others minutely. At the same time he was carrying forward some laboratory in-