serious problems of the hour. It is rather the gigantic task that we have committed to them that should give us pause. It is the variety and complexity of the burdens we have thrown upon them. They must be proficient in all of the known sciences. They must master all of the intricacies of private business. They go down into the bowels of the earth to safeguard the lives of miners and to establish mining processes conducive to safety and health. Perhaps in the future there will be an aeroplane inspection corps to prevent unjust discrimination in the interplanetary service. Laying all levity aside, our government cannot discharge adequately the duties now imposed upon it unless it is as wise as science, as astute as the cleverest business man, as efficient as the best equipped corporation, as strong as a great military machine.

And this extraordinary necessity has fallen upon us within recent times. A few generations ago a President of the United States, Andrew Jackson, could say in all seriousness: "The duties of all public officers are, or at least admit of being made, so plain and simple that men of intelligence may readily qualify themselves for their performance." Contrast this genial and comforting assumption with the following qualifications demanded of a mere assistant engineer by the Civil Service Commission of the United States according to specifications announced for an examination to be held on November 22 and 23, 1916.

(1) Mathematics and applied mechanics (covering algebra to and including problems involving quadratics; geometry, plane and solid; plane trigonometry and use of tables of logarithms or a slide rule; elements of calculus; and elementary questions involving principles of mechanics and hydraulics as set forth in college textbooks).

(2) Theory and practice of construction on land and in water (involving elementary knowledge of designing and constructing highways, railroad dams, retaining walls, foundation work, trusses, etc.).

(3) Theory and practice of topographic and hydrographic surveying, as covered in first-class surveying textbooks.

(4) Training and experience.

(5) Applicants must have had at least four years' practical experience in engineering. Graduation from a technical course in a college or university of recognized standing will be accepted in lieu of two years of the required experience. The rating in training and experience will be based upon general experience in civil engineering, and upon technical description in detail of some important work upon which the competitor has been engaged. This description must be handed to the examiner on the day of the examination.

Here, then, is the general problem as I see it:

I—How can we educate the public up to an appreciation of the necessity for trained and expert service in every branch of the government?

II—How can we so order our public service that it will attract the ablest men and women and guarantee progressive careers to those who prove loyal and efficient?

III—How can we develop a science of public administration in all of its branches, which will take the place of that pseudo-science of administrative law which is in the main a guide to the art of administrative nihilism?

IV—How can we best train our prospective civil servants in all of the various arts, sciences and crafts called for by the exigencies of modern government and adjust our curricula and educational methods to the requirements of government recruiting? In other words, how can we best gear up our educational ideals and institutions with the demands of efficient government?

V—How can we continue the training of those admitted to the lower ranges of the public service, while they are in service, thus preparing them for progressive advancement according to talents and aptitudes?

VI—How can we develop our civil service commissions into genuine recruiting agencies capable of supplying the government with exactly the type of service needed at any given moment and maintaining a loyal and efficient personnel? And this is said in no disparagement of the splendid work done by many

commissions under the handicaps now imposed by law, custom, and public opinion.

In brief, how can we make our science of government a true science of management rather than a device for distributing party spoils, and at the same time retain and develop those democratic ideals which we have thought worthy of this great nation? It may be that in your opinion I have laid before you not a problem but a paradox. If so, my retort in the true spirit of modern research is that only the impossible is worthy of the true scientific imagination.

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THE STATUS AND COMPENSATION OF THE CHEMIST IN PUBLIC SERVICE

By FREDERICK E. BREITHUT¹

Technicians, of all men, are supposed to be concrete and specific. They *are*—in the actual every-day practice of their professions. As soon as they begin to discuss the more general aspects of their work, however, they seem to lose their usual balance and their ability to stick to facts. Under these circumstances, they frequently indulge in a mellifluous eloquence which would make the average clergyman or politician turn green with envy.

Let me illustrate this point with a few examples from the field of engineering. Mr. Ernest McCollough, for instance, has written a book entitled "Engineering as a Vocation." On the whole, the work is an excellent one, evidently written by a man of wide experience who endeavors throughout to keep his feet on the ground and to avoid the oratorical flights of many of his colleagues. The book is supposed to be one which is to be placed in the hands of young engineering graduates for their advice and guidance. But in the chapter entitled "The Education of the Engineer" we read:

"The engineer changes the very face of nature. He makes millions of blades of grass grow where none grew before. He builds railroads which people the deserts. He erects factories and equips them. Thousands of people are employed through him * * * *"

In a more recent volume "Engineering as a Career—a Series of Papers by Eminent Engineers," we find the same tendency toward rhetorical fervor. Thus we have in the first paper a passage which reads:

"In the past the poets have sung of love and war. It has remained for the engineer to secure for the arts of peace the dominant position in civilization. The triumphs of transportation, of electric transmission and of power development have revolutionized the life of the race and caused during the last century a greater advance toward the millennium than has occurred in any preceding thousand years * * * *"

(Then follows a quotation from Kipling.)

The second paper in this highly interesting volume is entitled "Shall My Boy Become an Engineer?" It begins by telling us that:

"Forty years ago there were no triple or quadruple expansion steam engines, no commercial oil or gas engines, no steam turbines, no dynamos—the compound steam engine was the highest developed form of motive power, and the world had been waiting thousands of years for that. Forty years ago the Atlantic cable was not yet prepared for continuous service, and there were no telephones, no phonographs, no electric lamps, no trolley cars, no automobiles, no aeroplanes, no wireless telegraphy."

Then follows a brief historical account of the achievements of the last forty years, something about the value of new ideas, a few paragraphs on the misunderstandings which frequently arise between the technically trained engineer and his less enlightened brother, a few additional paragraphs on the need

¹ For the opportunity to collect and compile the data presented in this paper, the author is indebted to the Training School for Public Service, 261 Broadway, New York City.

of engineers in manufacturing in which we are assured that "the land, the sea and the air have been conquered, and the world has probably seen in these last forty years more diverse and remarkable inventions and discoveries than will ever again be seen in any future forty-year period in the world's history."

The final paragraph contains the only reference to the title of the article. It reads:

"The mechanical engineering profession is still in the very early morning of its life and it opens up to young men, who have a liking for mathematics and mechanics and at the same time a cultivated and balanced mind, an assurance of a high and respected position in life."

This last assurance must console the anxious parent seeking advice on "Shall My Boy Become an Engineer?"

It would be futile to continue an analysis of the remainder of the book. Much of it is excellent and to the point but, on the whole, it is not of sufficient definiteness or concreteness to aid either the young man about to decide whether he wants to study engineering or not, or the young engineering graduate.

Is it not a fact that chemists are as prone to this sort of thing as engineers and other technical men?

Picture the state of mind of the young graduate in chemistry. In many instances he does not know why he undertook a course in chemistry at all. Sometimes he has been led to this action by the glowing accounts of newspapers and magazines, by the well-meaning advice of vague enthusiasts and the fiery imaginations of commencement orators. Occasionally, the young man has actually taken an account of himself, of his natural aptitude and ability. Having convinced himself of the correctness of his choice of a life career, he has proceeded to acquire the necessary fundamentals of knowledge and technique.

In any case, as the young graduate emerges from the static, receptive status of the student to enter the dynamic, active condition of the worker he usually faces the world in a state of considerable bewilderment. All too frequently he has but little idea of the actualities of life. Having been stuffed with highly inflated notions of his future and coming face to face with the hard knocks of an indifferent world, he is apt to grow discouraged, to question his own ability, to lose faith in the idealistic elements of his vocation (and surely chemistry has enough of these without the necessity of exaggerating them), to look upon himself as a failure, when as a matter of fact, he is doing fairly well.

The young graduate certainly asks himself, and probably others, questions such as the following:

What are the usual prospects in my profession?

How do the compensations and rewards compare with those in other professions?

What is the usual rate of advancement?

What can a man normally expect to be earning by the time he reaches the age of thirty-five, let us say?

Strange as it may seem, but few attempts to answer these questions have been made and most of these are so general in nature that they are of little value. The instances offered above are as typical of chemistry as they are of engineering.

The engineering profession, however, has the advantage of the profession of the chemist in that several studies, based on definite, concrete information have been made from the standpoint of financial return. Financial return, of course, is not everything, though it is the *sine qua non* of much else.

The American Society of Civil Engineers, for example, has a special committee "to investigate the condition of employment of and compensation of civil engineers." This committee has made two reports and a third is promised.¹ In these reports graphs are presented which show (1) the average yearly compensations, the maximum, the minimum and that of the middle man, plotted against the years of experience, (2) the variation

of compensation with the character of employment, indicating the average compensation paid by the National Government, States, Municipalities, Technical Schools, Railroads, and Private Corporations and Companies, as well as the incomes of consulting engineers and engineering contractors; (3) the general averages of compensation arranged according to geographical distribution; (4) the relative compensations received by engineers who are graduates of technical schools and those who are not.

So far as I am aware, no studies of this nature have been made of the chemical profession.

The American Chemical Society now has a membership of over 8,200. Is not the time ripe for a survey of the field of the chemist? I want to offer as my first practical suggestion, a recommendation that a Committee on Status and Compensation of the American Chemical Society be appointed. If the New York Section takes the initiative and such a committee, representing this section, is appointed to-night they will be able to bring in their report at our December meeting. The action of the Section can then be brought before the Council and Directors at the general meeting to be held in conjunction with the American Association for the Advancement of Science in this city during the Christmas week.

Returning now to the specific subject of this paper and also to our young graduate in chemistry, let us ask a few questions:

Is there a career in chemistry in the public service?

What are the relative advantages and disadvantages of public service as compared with private?

Is public service in chemistry a useful stepping-stone, giving valuable experience, no matter what field the chemist eventually enters?

The time has come when these and related questions can be answered. In fact, they *must* be answered, and answered, too, in a manner other than the vague, general one which has sufficed heretofore.

To answer these questions we must know:

- (1) The numbers and salaries of each class of chemists in the service of our governments—national, state and municipal.
- (2) The nature of the work they are called upon to do.
- (3) The qualifications usually called for.
- (4) The training best adapted to fit men for public service, and the best manner of giving such training.¹
- (5) The likely number of appointments.
- (6) The rate of advancement and maximum return of the public servant.
- (7) The proposed schemes, if any, of appraisal and standardization of positions in chemistry in the public service.

It is the purpose of this paper to give this information by presenting the facts as they exist in the United States Government service, the service of New York State and the service of New York City.

I—THE CHEMIST IN THE SERVICE OF THE U. S. GOVERNMENT

One of the difficulties of making a survey of the chemical service of the Federal Government is the great confusion which exists with regard to titles. Different titles sometimes mean the same thing and the same title may mean different things. Not only that, but sometimes a man is classified as a clerk or as a laborer who is actually doing work of a chemical nature. On the other hand, men who have been trained as chemists are engaged in other governmental activities. In this paper we are treating of those who are actually engaged in the recognized chemical work of the Government departments.

In order to form a picture of the chemical service of the United States Government, a number of tables have been prepared.

¹ See *Proceedings of the American Society of Civil Engineers*, Vol. XL, No. 10 (December, 1914).

¹ See "Training for Public Service," *Engineering Record*, April 11, 1914, 69, 417, by Dean Herman G. Schneider.

TABLE 1

TITLE	DEPARTMENTS								TOTAL
	Treasury	War	Navy	Interior	Agriculture	Commerce	Civil Service Commission	Public Printer	
Alloy Chemist.....									1
Analyst.....									1
Assistant Alloy Chemist.....									1
Assistant Biochemist.....									1
Assistant in Biochemistry.....									1
Assistant Biochemist (Soil Fertility Investigations).....									1
Assistant Chemist.....		47	10		4				62
Assistant Chemist in Forest Products.....					4				4
Assistant Chemist (Mining).....					1				1
Assistant Explosives Chemist.....					1				1
Assistant Metallurgist.....				2					2
Assistant Organic Chemist.....				1					1
Assistant Physical Chemist.....				3					3
Assistant Technologist.....				1					1
Biochemist.....	1			1	2				3
Biochemist in charge of Soil Fertility Investigations.....					1				1
Biochemist (conducting biochemical investigations) in connection with plant diseases.....					1				1
Biochemist (Soil Fertility Investigations).....					4				4
Cement Chemist.....					1				1
Cement Expert.....					4				4
Cement Tester.....					1				1
Chemical Biologist.....					4				4
Chemical Engineer.....					1				1
Chemist.....	70	18	15	4	327	49	1	1	485
Chemist in Forest Products.....					5				5
Chemist (Fuel).....				3					3
Chemist (Physical).....				1					1
Chemist in Radioactivity.....				2					2
Chemist (Technical Assistant).....	2								2
Chief Chemist (Mineral).....				1					1
Chief Metallurgist.....				1					1
Chief Petroleum Technologist.....				1					1
Consulting Chemist (Fuel).....				4					4
Consulting Chemist (Mineral).....				1					1
Consulting Explosives Chemist.....				1					1
Consulting Metallurgical Chemist.....				2					2
Consulting Metallurgist.....				2					2
Consulting Quarry Technologist.....				1					1
Explosives Chemist.....				1					1
Inspector and Chemist.....	1								1
Junior Ceramic Chemist.....				1					1
Junior Chemist.....				1	1				2
Junior Chemist (Fuel).....			18						18
Junior Chemist in Radioactivity.....			4						4
Junior Chemist (Table Syrup Investigations).....					1				1
Junior Explosives Chemist.....				1					1
Junior Laboratory Inspector.....					3				3
Junior Physical Chemist.....				5					5
Junior Organic Chemist.....				1					1
Laboratory Aide.....			10						10
Laboratory Aid and Engineer.....					9				9
Laboratory Assistant.....				2					2
Laboratory Assistant (Conducting chemical phases of investigations of malnutrition of citrus trees).....					1				1
Laboratory Helper.....				1					1
Laboratory Inspector.....					4				4
Metallographer.....				1					1
Metallurgist.....				2					2
Mineral Technologist.....				1					1
Organic Chemist.....	2				2				4
Paper Plant Chemist.....				1					1
Physical Chemist.....				1					1
Physiological Chemist.....				1					1
Powder Expert.....				1					1
Quarry Technologist.....				1					1
Sanitary Chemist.....		5							5
Scientific Assistant in Chemistry.....					1				1
Scientific Assistant in Soil Chemistry.....					1				1
Scientific Assistant in Tobacco Investigations, conducting chemical phases of Tobacco Work.....					1				1
Second Assistant Chemist.....		1							1
Senior Biochemist.....					3				3
Senior Laboratory Inspector.....					7				7
Under Laboratory Inspector.....					2				2
TOTAL.....	81	20	73	94	397	49	1	1	716

TABLE 1 shows the number of chemists (and allied workers¹) under each title and in each department and the total number for each title and each department. There are 71 distinctive titles in the list. In compiling this table, the following departments were considered:

EXECUTIVE DEPARTMENTS	OTHER GOVERNMENT ESTABLISHMENTS
State	Navy
Treasury	Interior
War	Agriculture
Justice	Commerce
Post Office	Labor
	Interstate Commerce Commission
	Civil Service Commission
	Federal Reserve Board
	Federal Trade Commission
	Smithsonian Institution
	Government Printing Office
	The Public Printer

¹ Chemists and laboratory assistants have been combined in the Federal Service. The titles and compensations are not distinctive.

Of these the Departments printed in *italics* employ no chemists in the sense in which the term is used in this paper.

TABLE 2 gives the number of chemists employed in each federal department, arranged by bureaus. TABLE 3 contains a summary giving the numbers of chemists in the Federal service at each rate of pay and the total salaries at each rate. This table shows that the United States Government is paying \$1,447,305 per annum in salaries for its chemistry service. Summarizing the data

TABLE 2—NUMBER OF CHEMISTS IN EACH FEDERAL DEPARTMENT ARRANGED BY BUREAUS (see Table 4)

	No.	Total
TREASURY DEPARTMENT.....		81
Treasury Department.....	38	
Customs Service.....	32	
Division of Scientific Research.....	11	
WAR DEPARTMENT.....		20
Ordnance Department at Large.....	13	
Quartermaster Corps of The Army.....	4	
Engineer Department at Large—in connection with Filtration Plant, Washington, D. C.....	2	
Medical Department at Large.....	1	
NAVY DEPARTMENT.....		73
Navy Yards:		
Portsmouth, N. H., Industrial Department.....	1	
Boston, Mass., Supply Department.....	4	
New York, N. Y., Hull Division.....	9	
Supply Department.....	15	
Philadelphia, Pa., Supply Department.....	4	
Washington, D. C., Ordnance Department.....	5	
Norfolk, Va., Supply Department.....	4	
Mare Island, Cal., Machinery Division.....	2	
Supply Department.....	3	
Naval Magazine.....	1	
Puget Sound, Washington, Manufacturing Department.....	1	
Supply Department.....	1	
Naval Torpedo Station, Newport, R. I.....	1	
Naval Academy, Annapolis, Md., Engineering Experiment Station.....	3	
Naval Proving Ground, Indianhead, Md.....	15	
Naval Station, Olongapo, P. I., Naval Magazine and Chemical Laboratory.....	1	
Office of Inspector of Engineering Material, Munhall, Pa.....	1	
Pittsburgh, Pa.....	1	
Inspector of Hull Material, Philadelphia, Pa.....	1	
DEPARTMENT OF THE INTERIOR.....		94
U. S. Geological Survey.....	9	
U. S. Reclamation Service.....	6	
Bureau of Mines.....	79	
DEPARTMENT OF AGRICULTURE.....		397
Bureau of Plant Industry—Designation.....	20	
Forest Service—Designation.....	18	
Bureau of Chemistry.....	308	
Office of Public Roads and Rural Engineering—Designation.....	5	
Bureau of Animal Industry.....	28	
Bureau of Soils—Designation.....	18	
DEPARTMENT OF COMMERCE.....	49	
U. S. CIVIL SERVICE COMMISSION.....	1	
THE PUBLIC PRINTER.....	1	
GRAND TOTAL.....		716

TABLE 3—NUMBERS OF CHEMISTS, ETC., IN THE FEDERAL SERVICE AT EACH RATE OF PAY (see Table 4)

No.	Annual Salary	Total Salaries	No.	Annual Salary	Total Salaries	No.	Annual Salary	Total Salaries
1	\$ 500	\$ 500	19	\$ 2,280	\$43,320	5	\$ 912 ^(b)	\$ 4,560
1	800	800	3	2,300	6,900	2	984 ^(b)	1,968
10	9,000	9,000	1	2,340	2,340	1	1,050 ^(b)	1,050
1	960	960	11	2,400	26,400	1	1,056	1,056
2	1,000	2,000	14	2,500	35,000	1	1,080	1,080
4	1,020	4,080	21	2,520	52,920	1	1,128	1,128
3	1,080	3,240	1	2,580	2,580	11	1,152	12,672
60	1,200	72,000	5	2,640	13,200	17	1,200	20,400
5	1,260	6,300	7	2,700	18,900	1	1,248	1,248
4	1,320	5,280	2	2,750	5,500	3	1,272	3,816
6	1,380	8,280	3	2,760	8,280	1	1,320	1,320
11	1,400	15,400	2	2,820	5,640	2	1,344	2,688
28	1,440	40,320	28	3,000	84,000	1	1,350	1,350
21	1,500	31,500	1	3,240	3,240	1	1,368	1,368
4	1,560	6,240	4	3,250	13,000	1	1,440	1,440
9	1,600	14,400	1	3,420	3,420	1	1,500	1,500
46	1,620	74,520	5	3,500	17,500	8	1,512	12,096
3	1,680	5,040	2	3,600	7,200	1	1,536	1,536
5	1,740	8,700	1	3,750	3,750	2	1,584	3,168
89	1,800	160,200	1	3,800	3,800	1	1,656	1,656
1	1,860	1,860	8	4,000	32,000	1	1,725	1,725
1	1,900	1,900	1	4,200	4,200	2	1,800	3,600
3	1,920	5,760	5	4,800	24,000	1	1,920	1,920
7	1,980	13,860	2	5,000	10,000	1	2,100	2,100
28	2,000	56,000	1	1,000 ^(a)	1,000	59	2,400	141,600
27	2,040	55,080	2	1,170 ^(a)	2,340	7	2,700	18,900
5	2,100	10,500	2	1,200 ^(a)	2,400	1	2,880	2,880
2	2,160	4,320	2	1,800 ^(a)	3,600	15	3,000	45,000
9	2,200	19,800	5	2,000 ^(a)	10,000	2	3,150	6,300
3	2,220	6,660	4	2,500 ^(a)	10,000			
1	2,250	2,250	1	3,000 ^(a)	3,000	716		\$1,407,305

(a) Salaries paid on monthly basis.

(b) Salaries paid on *per diem* bases; figure given on 300 working days to the year.

Numbers employed at each rate are given in parentheses following the rate

(a)—Salaries paid on basis of daily wage: figures given obtained by allowing 300 working days per year.
(b)—Salaries paid on basis of monthly wage.

given in TABLE 3, and rearranging in groups at intervals of \$500 it will be seen that 92.2 per cent of these salaries lie in the region between \$1001 and \$3000.

ANNUAL SALARIES (or Equivalents)	No.	Per Cent of Total No.
\$ 500 to 1000	23	3.2
1001 to 1500	189	26.4
1501 to 2000	219	30.6
2001 to 2500	159	22.2
2501 to 3000	93	13.0
3001 to 3500	13	1.9
3501 to 4000	12	1.7
4001 to 4500	1	0.1
4501 to 5000	7	0.9
	716	100.0

In the discussion of the report of the Committee on Status and Compensation of the American Society of Civil Engineers which we have mentioned, it was brought out that, taking it all in all, the engineer who clears \$3000 per annum, year after year, is considered a success by his co-laborers. Of course,

there are many who earn very much more than this. On the other hand, there are a great many more who earn decidedly less. The same statements are true, we believe, with regard to the chemical profession. Ask any ordinary, every-day practicing chemist of good ability, who is thought to be doing fairly well by his colleagues, what he regards as a successful chemist from the standpoint of compensation and he will probably agree that the chemist who clears \$3000 per annum, year in and year out, is above the average.

Adopting this standard as a fair measure of the successful chemist, and rearranging the data covering the Federal service, we find the following:

	Below \$3000	\$3000 or over	TOTAL
Number.....	639	77	716
Per cent.....	89.2	10.8	100

The implications of this result are so glaringly obvious that they call for no comment.

TABLE 5—QUALIFICATIONS FOR APPOINTMENT AS CHEMISTS IN FEDERAL CIVIL SERVICE

TITLE OF POSITION	AGE, Sex, Etc.	(a)	EDUCATION, TRAINING AND EXPERIENCE	CONTENT OF EXAMINATION AND RELATIVE WEIGHTS	SALARY
Aid, qualified in Chemistry	Male 18 to 22 No Med. Cert.	N & A	<i>Relative weight, 20.</i> Special consideration given to graduates of mechanical training, technical or scientific schools, or for training in scientific or technical laboratories.	Elementary algebra, geometry and trigonometry, 25; general physics, 25; elementary chemistry, 30; training and experience, 20.	\$ 600 to \$ 840
Alloy Chemist	Male 25 to 40	A	<i>Relative weight, 80. Required:</i> Education equivalent to degree of Ph.D. in chemistry, and knowledge of physical chemistry, with special reference to the phase rule, and its application to alloys, a knowledge of microchemistry and metallography, and a reading knowledge of French and German. Also must have experience in foundry practice for nonferrous alloys, in the construction and manipulation of electrical furnaces, and in accurate high temperature measurements.	General education in scientific training, 40; practical experience and fitness, 40; publications or thesis, 20.	\$2400 to \$3000
Alloy Chemist Assistant	Male 21 to 35 No Med. Cert.	N	<i>Relative weight, 20. Required:</i> Graduation from college or university and in addition, 2 years' post-graduate work or 3 years' experience in nonferrous alloy industries.	Physical and electrochemistry, 35; French and German, 10; microchemistry and metallography, 25; thesis, 10; education, training and experience, 20.	\$1620
Alloy Chemist Junior	Male 21 to 35		<i>Relative weight, 20. Required:</i> Education equivalent to degree of Ph.D., knowledge of physical chemistry, with special reference to the phase rule and its application to commercial and scientific problems, and a reading knowledge of French and German.	Same as assistant alloy chemist.	\$1500 to \$1800
Analyst	Male 18 to 40	N & A	<i>Relative weight, 25. Required:</i> Graduation from high school; 2 years' college work in science, including physics, chemistry, laboratory work in inorganic analytical chemistry, and 1 year college mathematics.	General chemistry, 30; inorganic analytical chemistry, 30; physics, 15; training and experience, 25.	\$ 800 to \$1020
Assayer, Assistant	Male Over 18 No Med. Cert.	N	<i>Relative weight, 40. Required:</i> Education including a course in inorganic chemistry, both qualitative and quantitative; also 1 year's experience in positions requiring the making of quantitative chemical analyses for the various metals and assays for lead, silver and gold.	Practical questions, 60; training and experience, 40. Duties require determination of zinc, lead, copper, tin, antimony, iron, calcium, silver and gold, and general laboratory work.	\$1200
Assistant in Metabolism Investigations	Male Under 45 No Med. Cert.	N	<i>Relative weight, 35. Required:</i> Graduation in medicine, and 6 months' practical experience in work with the respiration apparatus, and the calorimeter.	General chemistry, 25; calorimetric, and respiration determinations, 40; education and experience, 35.	\$1500
Biochemist, Assistant	Male 25 to 45 No Med. Cert.	N	<i>Relative weight, 80. Required:</i> Ph.D. degree for graduation from college, and 3 years' post-graduate work in biochemistry.	General education, 40; laboratory experience, 40; publications or thesis, 20.	\$2000
Ceramic Chemist Associate (qualified in Glass Technology)	Male Under 45 No Med. Cert.	N & A	<i>Relative weight, 80. Required:</i> Degree in ceramic engineering or equivalent courses, and 3 years' experience in operating ceramic plants, of which 2 years must have been in the technical study of glass or in teaching glass technology; also a thorough knowledge of refractory clays is necessary.	General education and scientific training, 40; practical experience and fitness, 40; publications or thesis, 20.	\$2000 to \$2500
Ceramic Chemist, Junior	Male Under 35 No Med. Cert.	A	<i>Relative weight, 30. Required:</i> Graduation from 4 years' course in college or university, additional credit given for specialized training in ceramics and for experience in the pottery industry.	Inorganic chemistry, including mineral analysis, 15; mineralogy and blowpipe analysis, 10; French or German, 10; ceramics, 35; education and experience, 30.	\$1200 to \$1500
Chemical Engineer	Male 25 to 40	N & A	<i>Relative weight, 75. Required:</i> Ph.D. degree, training including special courses in physical chemistry, and 1 year's experience in a chemical or metallurgical industry.	General education and scientific training, 40; professional experience and fitness, 35; published or manuscript reports, 25.	\$1800 to \$3000
Chemical Engineer, Explosives	Male Under 40 No Med. Cert.	N	<i>Relative weight, 80. Required:</i> Ph.D. degree, and 5 years' experience, since receiving bachelor's degree, in chemical and physical investigation of explosives.	Education, 40; experience, 40; publications or manuscript reports, 20.	\$1800 to \$2400
Chemist, Ordnance Department	Male Under 35 No Med. Cert.	N	<i>Relative weight, 40. Required:</i> Graduation with bachelor's degree from 4 years' course in chemistry and 2 years' experience in analysis of iron and steel or melting and mixing of steel.	Physics, 10; general chemistry, 20; iron and steel analysis, 30; education and experience, 40.	\$1200
Chemist, Ordnance Department	Male Under 35 No Med. Cert.	N	<i>Relative weight, 40. Required:</i> 5 years' practical laboratory experience, 1 year in iron works. Each year of college work in a chemical course is equivalent to 1 year's experience.	Iron, steel, and nonferrous alloy analysis, 35; general industrial analysis, 25; education and experience, 40.	\$3.84 per day

TABLE 5—QUALIFICATIONS FOR APPOINTMENT AS CHEMISTS IN FEDERAL CIVIL SERVICE—(Continued)

TITLE OF POSITION	AGE, SEX, ETC.	(a)	EDUCATION, TRAINING AND EXPERIENCE	EXAMINATION, WEIGHTS, ETC.	SALARY
Chemist, Government Printing Office	Male 20 to 40	A	<i>Relative weight, 40. Required:</i> Bachelor's degree or equivalent, and practical experience in analysis of paper.	General chemistry, 30; analytical chemistry, 30; education, training, experience and fitness, 40.	\$1600
Chemist, Bureau of Chemistry	Male 30 to 45 No Med. Cert.	A	<i>Relative weight, 100. Required:</i> Education equivalent to bachelor's degree, including courses in organic and inorganic chemistry, bacteriology, histology, cytology, and 2 years' responsible administrative experience in charge of the enforcement of state or federal, food, drug or sanitation statutes.	Education, practical experience and fitness, 100.	\$4000
Chemist, qualified in Physical Chemistry			<i>Relative weight, 100. Required:</i> High order of scientific training equivalent to that required by leading American universities for a professorship in physical chemistry.	Education, training, technical and professional experience and achievements as shown by publications and results accomplished.	\$3500
Chemist, Assistant Engineer, Department at Large	Male Over 20	A	<i>Relative weight, 25. Required:</i> Educational training equivalent to B. S. degree.	Chemical arithmetic, 15; chemistry of water, 25; bacteriology of water, 25; microscopy of water, 10; education, training, experience and fitness, 25.	\$1000
Chemist, Assistant Custom-House Service	Male Over 18	N	<i>Relative weight, 45. Duties of position include making laboratory tests of sugar, chemical examination of tea, analysis of drugs, chemicals, oils, acids, etc., the assay of gold, silver and lead, the examination of starches, flours, fibers, and dyes, and general analytical work.</i>	General physics, 20; general and analytical chemistry, 35; education, training, experience and fitness, 45.	\$1200
Chemist, Assistant Geological Surveying	Male Over 20	A	<i>Relative weight, 30. Required:</i> Education equivalent to B. S. degree.	Analytical chemistry, 30; general chemistry, 20; French, 10; German, 10; education, training, experience and fitness, 30.	\$1200
Chemist, Assistant Navy Yard	Male Over 20		<i>Relative weight, 25. Required:</i> Educational training equivalent to B.S. degree.	General chemistry, 25; qualitative analysis, 25; education, training, experience and fitness, 25.	\$4.00 per day
Chemist, Assistant Bureau of Standards	Male 20 to 30	A	<i>Relative weight, 25. Required:</i> Graduation from 4 years' course in chemistry.	General physics, 25; general chemistry, 50; education, training and fitness, 25.	\$1000 to \$1620
Chemist, Assistant Bureau of Chemistry, Department of Agriculture	Men & Women Over 20	N & A	<i>Relative weight, 40. Required:</i> Educational training equivalent to B. S. degree with 3 years' course in chemistry.	Practical questions on theoretical and applied chemistry, consisting of general, inorganic and organic chemistry, physical chemistry, and analytical chemistry, 50; translation into English from French or German technical literature, 10; education, training, experience and fitness, 40.	\$1200 to \$1800
Chemist, Assistant Ordnance Department	Male Over 20 No Med. Cert.	N	<i>Relative weight, 50. Required:</i> B.S. degree from 4 years' course in chemistry or chemical engineering, including 1 year in organic chemistry. Experience in testing analysis or manufacture of explosives is desirable.	Chemistry (manufacture and testing of explosives), 30; general chemistry, including inorganic, organic and analytical chemistry, 20; education and experience, 50.	\$1320
Chemist, Assistant Office of Public Roads, Department of Agriculture	Male 25 to 50	A	<i>Relative weight, 90. Required:</i> Educational training equivalent to graduation from chemical or chemical engineering course.	General education and technical training, 25; practical laboratory experience, particularly in testing bituminous materials, 40; practical field experience in use of bituminous road materials, 25; publications or thesis, 10.	\$1800 to \$2250
Chemist, Assistant Bureau of Mines	Male Under 40 No Med. Cert.	N	<i>Relative weight, 80. Required:</i> Educational training equivalent to graduation from chemical or chemical engineering course, and 2 years' graduate work or 2 years' experience in electrochemistry or chemical engineering.	Undergraduate education and training, 40; graduate education, experience and fitness, 40; publications, 20.	\$1800 to \$3000
Chemist, Associate (qualified in Chemistry of Metals) Bureau of Standards	Male 25 to 45 No Med. Cert.	A	<i>Relative weight, 75. Required:</i> Graduation with bachelor's degree in chemistry from full 4 years' course and 3 years' subsequent research work in chemistry of metals and alloys.	Education, 35; experience, 40; publications or thesis, 25.	\$2000 to \$2500
Chemist, Junior	Men & Women Over 20 No Med. Cert.	N & A	<i>Relative weight, 30. Required:</i> Graduation from full 4 years' course in chemistry.	General chemistry, 15; elementary physics, 10; French and German, 10; practical questions for each optional subject chosen, 35; education and experience, 30. Examinations are given in following optional subjects: Advanced inorganic chemistry, analytical chemistry, biological chemistry, dairy chemistry, food chemistry, metallurgical chemistry, organic chemistry, pharmaceutical chemistry, physical chemistry, sanitary chemistry and soil chemistry.	\$1200 to \$1440
Chemist, Junior Bureau of Mines	Male 21 to 40 Med. Cert.	N & A	<i>Relative weight, 25. Required:</i> Educational training equivalent to graduation from 4 years' course in technical college, the larger portion of which course was in chemistry, including a considerable amount of laboratory practice, especially in quantitative analysis.	Mineralogy, 5; translation from French and German technical works, 10; physics, including calculation, 10; chemistry, 50; educational training, experience and fitness, 25.	\$1020 to \$1380
Chemist, Junior Geological Surveying	Male 20 to 33	A	<i>Relative weight, 40. Required:</i> Educational training equivalent to B.S. degree.	General inorganic chemistry, 40; mathematics, including plain trigonometry, 10; physical geography, 10; education, training, experience and fitness, 40.	\$1020 to \$1380
Chemist, Junior (qualified in Fuels)	Male Over 20 No Med. Cert.	N & A	<i>Relative weight, 30. Required:</i> Graduation from 4 years' course in chemistry or chemical engineering.	General chemistry, 15; elementary physics, 10; French or German, 10; practical questions in chemistry of fuels, 35; education and experience, 30.	\$1020 to \$1200
Chemist in Chemical Metallurgy, Assistant	Male Under 30 No Med. Cert.	A	<i>Relative weight, 35. Required:</i> Graduation from 4 years' course in chemistry preferably with specialization in metallurgical chemistry, and 1 year's experience either in graduate or laboratory work in metallurgical chemistry.	General physics, 10; general chemistry, 10; chemical metallurgy, 35; education and experience, 35.	\$1200 to \$1620

TABLE 5—QUALIFICATIONS FOR APPOINTMENT AS CHEMISTS IN FEDERAL CIVIL SERVICE—(Continued)					
TITLE OF POSITION	AGE, SEX, ETC.	(a)	EDUCATION, TRAINING AND EXPERIENCE	EXAMINATION, WEIGHTS, ETC.	SALARY
Chemist's Aid	Men & Women 18 to 30 No Med. Cert.	N & A	<i>Relative weight, 30. Required:</i> 1 year college chemistry or 3 years' experience in chemical laboratory, or 1 year's experience in chemical laboratory and graduation from manual training school.	Elementary chemistry, including simple problems in qualitative and quantitative analysis, chemical calculations, and practical laboratory manipulations, or simple elementary physics, 70; education and experience, 30.	\$ 720 to \$1200
Chief, Bureau of Chemistry, Assistant	Male 30 to 45	A	<i>Relative weight, 100. Required:</i> Educational training, including M.D. degree, and special training in analytical and physiological chemistry, and 3 years' experience as a medico-legal expert and some experience as an administrative officer.	Education, training, practical experience, fitness and publications, 100.	\$4000
Dairy Chemist	Male	N & A	<i>Relative weight, 70. Required:</i> Education equivalent to Ph.D. degree, and thorough training in biochemistry.	General education, 20; college education in chemistry, 30; practical experience and fitness for conducting investigations along the lines related to chemistry, including experience in teaching, research work and commercial work, 20; plans for an investigation, 15; thesis on some subject relating to chemistry, 15.	\$1800
Electrochemical Engineer	Male Under 40 No Med. Cert.	A	<i>Relative weight, 30. Required:</i> Graduation from 4 years' course in chemistry, and 2 years' experience in construction and operation of electric furnaces.	Chemistry, 25; physics, 15; construction and operation of electric furnaces, 30; education and experience, 30.	\$1500 to \$1800
Electrometallurgist	Male 25 to 40	N & A	<i>Relative weight, 80. Required:</i> Educational training equivalent to graduation from college, including courses in geology, chemistry, physics and metallurgy, and 3 years' experience in electric furnaces.	General education and scientific training, 40; practical experience and fitness, 40; publications or thesis, 20.	\$1800 to \$3000
Explosives Chemist, Bureau of Mines	Male Under 40 No Med. Cert.	N	<i>Relative weight, 75. Required:</i> Graduation from four years' course in chemistry, and 5 years' experience, including research work in explosives. Graduate work in chemistry accepted in lieu of experience.	Education, 25; experience, 50; publications, 25.	\$2100 to \$2700
Forest Products Chemist	Male 20 to 50	N & A	<i>Relative weight, 40. Required:</i> Educational training equivalent to bachelor's degree or chemical engineer's degree, and 3 years' experience in research or industrial chemical work. Desired a knowledge of the chemistry of wood distillation, pulp manufacture, tannins and gums derived from wood, and wood preservation.	Organic chemistry, 15; chemistry in industries utilizing forest products, 25; thesis or publications, 20; education, training and experience, 40.	\$1600 to \$2500
Forest Products Chemist, Assistant	Male Under 50	N & A	<i>Relative weight, 25. Required:</i> Graduation with degree of B.S. or chemical engineer.	Chemical arithmetic, 20; general chemistry (including qualitative and quantitative analysis, physical chemistry, and general organic chemistry), 35; chemistry and technology of wood, and wood-using industries, 20; education, training and experience, 25.	\$ 900 to \$1200
Fuels Chemist, Junior	Male Over 20 No Med. Cert.	N	<i>Relative weight, 25. Required:</i> Graduation from 4 years' course in physical and organic chemistry in technical college.	General and physical chemistry, 25; organic chemistry, 25; elementary physics, 15; translation from French and German technical works, 10; training and experience, 25.	\$1200 to \$1500
Inorganic Chemist, Philippine Service	Male Under 40 Med. Cert.	N	<i>Relative weight, 80. Required:</i> Graduation from 4 years' course in chemistry.	Education, 40; experience, 40; publications or thesis, 20.	\$1600 to \$2250
Laboratory Aid in Chemistry and Physics	Men & Women 18 to 25 No Med. Cert.	N & A	<i>Relative weight, 20. Required:</i> 2 years' college work or 2 years' experience in chemical or physical laboratory.	Elementary algebra, geometry and trigonometry, 15; general chemistry, 25; general physics, 25; free-hand and elementary mechanical drawing, 15; education and experience, 20.	\$ 600 to \$ 900
Laboratory Assistant in Chemistry, Bureau of Standards	Male 20 to 30	A	<i>Relative weight, 25. Required:</i> Graduation from 4 years' course in chemistry or equivalent. Special consideration given for reading knowledge of French and German.	General physics, 25; general chemistry, 50; education and experience, 25.	\$1000 to \$1440
Leather Chemist	Male Under 40 Med. Cert.	N	<i>Relative weight, 40. Required:</i> Graduation in science, and 2 years' practical course in tannery.	Practical questions in chemistry and tannery, 40; thesis, 20; education, experience, 40.	\$1600
Master Steel Maker	Male 25 to 45 No Med. Cert.	N	<i>Relative weight, 90. Required:</i> Bachelor's degree in chemistry or metallurgy, and 3 years' subsequent experience in physical metallurgy in research or industrial plant laboratories, or as foreman of a steel casting plant.	Education, 30; professional experience, 60; publications, official reports or thesis, 10. Should have expert knowledge of molding, the treatment of steel molding sand, the making of molds and cores for steel castings, the maintenance and operation of the Tropenas converter and small open-hearth furnaces, the operation of iron cupolas, and the making up of charges to meet specific requirements. In addition, he must be able to make qualitative and quantitative analyses of wrought iron, pig iron, ferromanganese, ferrosilicon, ferrochrome, ferroaluminum, ferrotungsten, ferronickel, ganister, limestone, dolomite, slags, and silica sand, also silica brick, common fire brick, and clays. He must know the effect of the different elements in steel and have a full knowledge of the best treatment of steels.	\$8.00 per day
Metallographist, War Department	Male Under 40 No Med. Cert.	N	<i>Relative weight, 80. Required:</i> Bachelor's degree from four years' chemical course and 3 years' experience in metallurgical work, including the use of the microscope in examination of metals, and the making and interpretation of photomicrographs and metals.	Education, 40; experience, 40; publications or reports, 20.	\$2000

TABLE 5—QUALIFICATIONS FOR APPOINTMENT AS CHEMISTS IN FEDERAL CIVIL SERVICE—(Continued)

TITLE OF POSITION	AGE, SEX, ETC.	(a)	EDUCATION, TRAINING AND EXPERIENCE	EXAMINATION, WEIGHTS, ETC.	SALARY
Metallurgical Chemist, Ordnance Department	Male Under 45 No Med. Cert.	N	<i>Relative weight, 80. Required:</i> Bachelor's degree from four years' course in chemistry, and 1 year's subsequent experience in metallurgical chemistry, either in graduate work or in a laboratory.	Education, 40; experience, 40; publications or reports, 20.	\$1800
Metallurgical Chemist, Ordnance Department	Male Under 50 No Med. Cert.	N	<i>Relative weight, 80. Required:</i> 5 years' experience in chemical laboratory, including metallurgical work. Bachelor's degree in chemistry accepted in lieu of 3 years' experience.	Education, 20; experience, 60; publications or thesis, 20.	\$2500
Metallurgist, qualified in Metallography, Ordnance Department	Male 20 to 45	N	<i>Relative weight, 80. Required:</i> Education equivalent to graduation from technical school or college. Desired, experience in manufacture and heat treatment of iron, steel, bronze, and other alloys, and also experience in examining such metals under the microscope.	General education and technical training, 40; practical experience and fitness, 40; publications or thesis, 20.	\$2000
Metallurgist, for Work with Smelter Fumes, Bureau of Mines	Male 25 to 40	N & A	<i>Relative weight, 80. Required:</i> Education equivalent to bachelor's degree, including courses in chemistry, physics, metallurgy, and mineralogy, and in addition, 3 years' experience in chemical and metallurgical phases of smelter operations in both copper and lead, and in the examination of smelter fumes. Also ability as a writer of reports.	General education and technical training, 40; practical experience and fitness, 40; publications or reports, 20.	\$2700 to \$3600
Metallurgist, for Work in Low Grade Ores, Bureau of Mines	Male 30 to 45	N & A	<i>Relative weight, 70. Required:</i> Education equivalent to bachelor's degree, including courses in chemistry, metallurgy, and geology, and in addition, 5 years' experience in metal mining or metallurgical operations, also ability as a writer of reports.	General education and technical training, 35; professional experience and fitness, 35; publications or reports, 30.	\$3000 to \$4000
Metallurgist, Assistant Bureau of Mines (Work in Low Grade & Complex Ores)	Male 25 to 45 No Med. Cert.	N	<i>Relative weight, 90. Required:</i> College or university course in chemistry, metallurgy and geology, and 5 years' experience in ore-dressing and metallurgical operations.	Education, 30; professional experience, 60; publications, official reports, or thesis, 10.	\$1800 to \$3000
Mineral Technologist, Bureau of Mines	Male 25 to 45 No Med. Cert.	N	<i>Relative weight, 70. Required:</i> Graduation from technical or mining school, and 3 years' experience in mineral technology.	General education and technical training, 30; experience in connection with rarer minerals and fitness, 40; publications, or technical or professional reports, 30.	\$2400 to \$3600
Organic Chemist, Philippine Service	Male Under 40 Med. Cert.	N	<i>Relative weight, 80. Required:</i> Graduation from four years' course in chemistry.	Education, 40; experience, 40; publications or thesis, 20.	\$1600 to \$2250
Organic Chemist, Bureau of Chemistry, Hygienic Laboratory, Public Health Service	Male 21 to 40 No Med. Cert.	N & A	<i>Relative weight, 60. Required:</i> Degree of Ph.D. in chemistry.	General education and scientific training, 30; technical and professional experience, 30; publications and other evidence indicating ability to do research work, 40.	\$1800 to \$2500
Petroleum Chemist, Assistant, Bureau of Mines	Male 25 to 35	N & A	<i>Relative weight, 80. Required:</i> Graduation from college or university. Desired, Ph.D. degree in chemistry and physics, and 1 year's experience in chemical and physical researches in petroleum.	General education and technical training, 50; professional experience, and fitness, 30; publications or reports, 20.	\$1800 to \$2160
Pharmaceutical Chemist, Bureau of Chemistry	Men & Women No Med. Cert.	A	<i>Relative weight, 70. Required:</i> Ph.D. degree in chemistry and at least 3 years' experience in research in pharmaceutical chemistry or in manufacturing of pharmaceutical products.	Education, 30; experience, 40; publications (original contributions to scientific literature), 30.	\$1800 to \$2500
Pharmaceutical Research Chemist, Bureau of Chemistry	Male No Med. Cert.	A	<i>Relative weight, 80. Required:</i> Graduation in pharmacy, degree of Ph.D. in chemistry or pharmacy, and 5 years' experience in research laboratory in chemical pharmaceutical investigations.	Education, 40; experience, 40; publications, 20.	\$3000
Pharmacological Aid, Bureau of Chemistry	Men & Women 20 to 35 No Med. Cert.	A	<i>Relative weight, 25. Required:</i> 2 years' attendance at college or university.	Pharmacological and physiological methods, 30; physiology, 25; biochemistry, 20; education and experience, 25.	\$ 900 to \$1200
Pharmacologist, Junior Bureau of Chemistry	Male 21 to 35 No Med. Cert.	A	<i>Relative weight, 25. Required:</i> Graduation from college or university.	Pharmacological methods, 40; physiology, 25; chemistry, 10; education and experience, 25.	\$1200 to \$1500
Physical Chemist, Philippine Service	Male 18 to 40 Med. Cert.		<i>Relative weight, 80. Required:</i> Educational training equivalent to Ph.D. in chemistry.	General education and scientific training, 40; practical experience and fitness, 40; publications or thesis, 20.	\$2250
Physical Chemist, Junior, Bureau of Chemistry	Male 25 to 40 No Med. Cert.	A	<i>Relative weight, 80. Required:</i> Ph.D. degree and 3 years' experience in some field of chemical dynamics, including some investigation in the physical chemistry of sugars.	Education, 40; experience, 30; thesis (dealing with the more recent advances in chemistry of sugars), 20.	\$1800
Physical Chemist, Junior, Bureau of Mines	Male 20 to 30	N & A	<i>Relative weight, 30. Required:</i> 4 years' collegiate work in science, including special courses in chemistry and physics, and 1 year's laboratory work in physical chemistry.	Chemistry and physics, 15; physical chemistry, 25; translation from French or German technical literature, 10; thesis or essay, 20; training, experience and fitness, 30.	\$1020 to \$1200
Physical Metallurgist, Navy Yard	Male 25 to 45 No Med. Cert.	N & A	<i>Relative weight, 60. Required:</i> Bachelor's degree in chemistry or metallurgy, and 1 year's experience in physical metallurgy in research or industrial plant laboratories.	Physical metallurgy, 40; education, 40; experience, 20. Duties require supervision of chain manufacture.	\$6.00 to \$8.00 per day
Physiological Chemist, Bureau of Animal Industry, Department of Agriculture	Male Under 45 No Med. Cert.	N	<i>Relative weight, 80. Required:</i> Ph.D. degree in chemistry, the work for such degree having included physiological chemistry and physiology.	Education, 35; experience, 45; publications, 20. Duties are to assist with investigation in milk secretion.	\$1800 to \$2220
Professor of Chemistry, Hygienic Laboratory Public Health Service	Male Under 40	A	<i>Relative weight, 100. Required:</i> Graduation from college or university, and 10 years' practical experience in chemistry and practical hygiene. Desired, one qualified to undertake work in sanitary chemistry and hygiene of a research co-operative and supervisory character, and familiar with sanitary engineering and bacteriology.	General scientific education and training, practical experience and fitness, and publications, 100.	\$4500

TABLE 5—QUALIFICATIONS FOR APPOINTMENT AS CHEMISTS IN FEDERAL CIVIL SERVICE—(Continued)

TITLE OF POSITION	AGE, SEX, ETC.	(a)	EDUCATION, TRAINING AND EXPERIENCE	EXAMINATION, WEIGHTS, ETC.	SALARY
Radioactivity Chemist, Bureau of Mines	Male 22 to 45	N & A	<i>Relative weight, 70. Required:</i> Education equivalent to Ph.D. degree and practical experience in radioactivity and the rarer metals.	General education and scientific training, 30; practical experience and fitness, 40; publications or thesis, 30.	\$1800 to \$2160
Radioactivity Chemist, Junior Bureau of Mines	Male Under 35 No Med. Cert.	N	<i>Relative weight, 40. Required:</i> Graduation from 4 years' course in chemistry.	Inorganic and physical chemistry with special reference to the rarer metals and radioactivity, 30; mineralogy and blowpipe analysis, 10; French and German, 10; thesis, 10; education and experience, 40.	\$1200 to \$1500
Research Chemist, Bureau of Animal Industry, Depart- ment of Agriculture	Male 24 to 45	A	<i>Relative weight, 80. Required:</i> Degree of Ph.D. in chemistry.	General education and scientific training, 40; practical or professional experience and fitness, 40; publications, 20.	\$1800
Sanitary Chemist, Hygienic Laboratory, Public Health Service	Male 25 to 35		<i>Relative weight, 80. Required:</i> Bachelor's degree from scientific course, including sanitary chemistry, bacteriology, and public health work, and 3 years' experience in laboratory and field work in water purification, sewage purification, stream pollution, and chemistry and bacteriology of milk. Knowledge of French and German and of elementary engineering is desirable.	General education and technical training, 40; technical or professional experience and fitness, 40; publications or thesis, 20.	\$1800 to \$2500
Soil Laboratory Assistant, Bureau of Soils, Department of Agriculture	Male 21 to 30	A	<i>Relative weight, 30. Required:</i> 3 years' college work in science, including courses in general and analytical chemistry.	General chemistry, 15; analytical chemistry, 15; soil chemistry, 30; German or French, 10; education, training, experience and fitness, 30.	\$1000 to \$1500
Soil Chemistry Assistant, Bureau of Soils, Department of Agriculture	Male 22 to 40	A	<i>Relative weight, 15. Required:</i> Education equivalent to B.S. degree.	Inorganic and analytical chemistry, 20; organic chemistry, 10; physical chemistry, 20; soil chemistry, 20; French or German, 15; education, training, experience and fitness, 15.	\$1500 to \$1800
Specialist in Agricultural, Biological and Physiological Chemistry, Office of Experiment Stations, Department of Agriculture	Male 21 to 40 No Med. Cert.	A	<i>Relative weight, 35. Required:</i> Graduation from college or university, with specialization in chemistry, including laboratory investigation in agricultural, biological, or physiological chemistry. SPECIAL consideration given to experience in preparing bibliographies or reviews of literature in agricultural, biological or physiological chemistry, and for familiarity with the methods of agricultural analysis, and with immunochemistry and serum therapy.	Biological and physiological chemistry, 25; preparation and abstract of English, French and German articles, 40; education and experience, 35.	\$1500 to \$1800
Superintendent of Acid Plants	Male Over 20 No Med. Cert.	N	<i>Relative weight, 40. Required:</i> 1 year of college chemistry, including course in qualitative analysis, and 2 years' practical experience, part of which was in actual supervision in the manufacture of nitric acid, and contact sulfuric acid.	General chemistry, 20; practical questions in acid manufacture, 40; education and experience, 40.	\$6.00 per day
Technical Assistant, Customs Service	Male 21 to 45 No Med. Cert.	N	<i>Relative weight, 35. Required:</i> Bachelor's degree, including courses in chemistry, or 2 years' specialization in chemistry.	Arithmetic, 10; report-writing, 10; chemistry, 30; thesis, 15; education and experience, 35. Duties include assisting in tea examination and keeping records and reports.	\$1200

Having completed the picture of the present constitution of the Federal service in chemistry, the next questions before us are those of the qualifications usually called for in filling these positions and the probable number of vacancies.

TABLE 5 contains a summary of the examinations in chemistry in the Federal service of the last five years, giving the titles, qualifications, relative weights, content of examinations and weights of subjects, and salaries. TABLE 6 gives the number of appointments made to positions in chemistry in the Federal service during the fiscal years 1911-1915.

TABLES 1 to 4 are based on replies to a circular letter (7/28/16) to the departments of the Federal Government enumerated above by the Hon. Jos. V. Flynn, member of Congress from the Third District of New York. These replies were signed in the case of the Executive Departments either by the Secretary of the Department or some one directly designated by him. In the other Government establishments the answers were signed by the properly constituted authorities. It can therefore be stated that the information is up-to-date, reliable and authoritative. It is a pleasure to acknowledge our indebted-

TABLE 6—APPOINTMENTS OF CHEMISTS MADE TO FEDERAL CIVIL SERVICE FROM COMPETITIVE ELIGIBLE LISTS FOR FISCAL YEARS 1911-1915

POSITION	Number Appointed						POSITION	Number Appointed					
	1911	12	13	14	15	TOTAL		1911	12	13	14	15	TOTAL
Aid qualified in Chemistry	..	..	..	1	1	2	Medico-Chemical Analyst	..	1	..	..	..	1
Alloy Chemist	..	..	1	..	..	1	Metallurgical Chemist	..	1	..	..	..	1
Alloy Chemist, Junior	..	..	1	..	..	1	Metallurgical Chemist and Assayer	..	1	..	..	..	1
Analyst	..	..	2	..	..	2	Metallurgist	..	..	..	1	2	3
Analytical Chemist	..	..	..	..	1	1	Metallurgist, Assistant	..	..	..	1	..	1
Assayer's Assistant	2	2	..	..	..	4	Metallurgist, Chief	..	..	..	1	..	1
Bacteriological Chemist	1	2	..	..	..	3	Mineral Examiner	1	..	5	..	..	6
Biochemist, Assistant	..	..	..	1	1	1	Mineral Technologist	..	1	..	..	..	1
Ceramic Chemist, Junior	..	1	..	..	..	1	Organic Chemist	..	2	..	10	..	12
Chemical Metallurgy, Assistant	..	..	..	1	1	1	Pharmaceutical Chemist	..	3	..	1	..	4
Chemist	2	2	..	..	..	4	Pharmacologist, Assistant	..	..	1	..	..	1
Chemist, Ordnance Department	..	..	1	..	..	1	Pharmacologist, Junior	..	..	..	2	..	2
Chemist, Assistant	..	17	14	34	2	67	Pharmacology, Technical Assistant in	..	..	..	2	..	2
Chemist, Assistant, Bureau of Standards	..	4	..	..	..	4	Pharmacology, Scientific Assistant in	..	..	..	1	..	1
Department of Agriculture	..	18	25	..	..	43	Professor of Pharmacology	..	..	1	..	..	1
Ordnance Department	15	..	..	..	..	15	Physical Chemist, Assistant	..	2	2	1	..	5
In Sugar Plant Investigations	..	..	1	..	..	1	Physical Chemist, Chief	..	3	..	..	..	3
Chemist's Aid	..	..	..	..	5	5	Physical Chemist, Junior	..	2	..	..	..	2
Dairy Chemist	..	..	3	2	..	5	Public Roads Chemist, Assistant	..	..	1	..	..	1
Dairy Chemist, Assistant	..	2	..	..	..	2	Professor of Chemistry	..	..	1	1	2	4
Dairy Chemistry, Assistant in	3	..	..	..	..	3	Radioactivity Chemist, Assistant	..	..	1	..	..	1
Expert Chemist	..	2	..	..	..	2	Radioactivity Chemist, Junior	..	..	1	1	3	5
Forest Products Chemist	1	..	..	..	1	2	Sanitary Chemist	..	..	5	1	..	6
Forest Products Chemist, Assistant	2	2	4	1	..	9	Scientist in Soil Chemistry	3	2	..	..	..	5
Junior Chemist	5	15	6	12	52	90	Soil Biochemist	..	..	..	3	2	5
Laboratory Assistant in Chemistry	..	..	..	..	1	1	Soil Chemistry, Assistant in	..	..	1	..	..	1

ness to Mr. Flynn and to express our sincere thanks to him. We wish to express our thanks also to Mr. John T. Doyle, Secretary of the United States Civil Service Commission, for valuable aid generously given.

TABLE 5 was compiled from the examination announcements of the United States Civil Service Commission for the last five years; TABLE 6, from the annual reports of the United States Civil Service Commission for the fiscal years 1911-1915.

II—THE CHEMIST IN THE SERVICE OF NEW YORK STATE

The same confusion with regard to titles which was noted in the Federal service exists in the service of New York State. It may be, therefore, that some titles which should have been included in the data which follow, have been omitted.¹ Possibly some which have been included should have been left out. The only way to settle the question would be to appraise each position individually. This would involve an expenditure of energy incommensurate with the end to be attained. The picture of the chemical service of New York State, as here presented, is believed to be sufficiently correct for all practical purposes. It is accurate as far as it goes.

As with the Federal service, only recognized chemical positions are considered. In what follows, we have proceeded in exactly the same manner as in the Federal service except that the laboratory assistant group is treated separately from the chemist group. In this regard the titles and corresponding compensations in the New York State service are more distinctive than in the Federal service. In the general salary summaries, laboratory assistants have been omitted.

Positions in the Public Service Commission, 1st District, are under the jurisdiction of the State Civil Service Commission. On the other hand, the work of this Commission is confined to New York City as contrasted with that of the Public Service Commission, 2nd District, which includes the rest of New York State. The employees of the Public Service Commission, 1st District, are paid by the City of New York.² On the whole, therefore, it has seemed advisable to treat the Public Service Commission, 1st District, as a Department of the City of New York rather than of the State. If, for any reason, one wants to consider them along with the State service, it is necessary only to transfer the data given in Section III to Section II and to make the corresponding additions and subtractions.

TABLE 7

CHEMISTS AND LABORATORY ASSISTANTS IN THE SERVICE OF NEW YORK STATE JANUARY 1, 1916		of							
TITLE		Agr. Expt. Sta., Geneva	School of Agr., Morrisville	Department of Agriculture	Department of Health	Highway Commission	Industrial Commission	Institute for Study of Malignant Diseases	Psychiatric Institute
Analytical Chemist.....	1	1	1	1	1	1	1	1	1
Assistant Chemist.....	8	1	1	1	1	1	1	1	1
Associate Chemist.....	3	1	1	1	1	1	1	1	1
Chemical Engineer.....	1	1	1	1	1	1	1	1	1
Chemist.....	1	1	1	1	1	1	1	1	1
Chief Chemist.....	1	1	1	1	1	1	1	1	1
Consulting Chemist.....	1	1	1	1	1	1	1	1	1
Director of Laboratories and Research.....	1	1	1	1	1	1	1	1	1
Physiological Chemist.....	1	1	1	1	1	1	1	1	1
Sanitary Chemist.....	1	1	1	1	1	1	1	1	1
Special Assistant in Chemistry.....	1	1	1	1	1	1	1	1	1
Water Analyst.....	1	1	1	1	1	1	1	1	1
TOTAL.....	12	11	5	2	1	1	1	1	1
LABORATORY ASSISTANTS									
Laboratory Apprentice.....	1	1	1	1	1	1	1	1	1
Laboratory Assistant.....	1	1	1	1	1	1	1	1	1
Laboratory Helper.....	1	1	1	1	1	1	1	1	1
TOTAL.....	1	1	1	1	1	1	1	1	1

¹ The inspectional service, especially, has certain positions which call for chemical qualifications.

² With the exception of the Commissioners, Counsel and Secretary.

TABLE 7 shows the number of chemists and the laboratory assistants under each title in each State department and the total number for each title and for each department.

TABLE 8 gives the titles, numbers and individual salaries of chemists and laboratory assistants for the whole New York State service.

TABLE 8—CHEMISTS AND LABORATORY ASSISTANTS IN THE EMPLOY OF THE STATE OF NEW YORK, JANUARY 1, 1916

DEPARTMENT	TITLE	No.	SALARIES
Agricultural Experiment Station, Geneva	Chemist	1	1 @ \$3000
	Associate Chemist	3	2 @ 1800
		1	@ 2000
	Assistant Chemist	8	4 @ 1200
Department of Agriculture	Chief Chemist	1	1 @ 3000
	Chemist	8	1 @ 600
		1	@ 1200
		1	@ 1500
Department of Health	Assistant Chemist	1	1 @ 1200
	Consulting Chemist	1	1 @ 1500
	Director of Laboratories and Research	1	1 @ 1680
	Sanitary Chemist	1	1 @ 1800
Highway Commission	Physiological Chemist	2	2 @ 2000
	Water Analyst	1	1 @ 3000
		1	@ 800
		1	@ 15 da.
Industrial Commission	Chemist	1	1 @ 4000
		1	@ 2800
		1	@ 1500
		2	@ 1800
Psychiatric Institute	Chemical Engineer	1	1 @ 2400
		1	@ 6 da.
		1	@ 3500
		1	@ 3000
Saratoga Reservation	Special Assistant in Chemistry	1	1 @ 1200
	Analytical Chemist	1	1 @ 1800
		1	@ 720
		1	@ 540
School of Agriculture, Morrisville	Laboratory Assistant	13	6 @ 720
		3	@ 900
		1	@ 960
		3	@ 1200
Department of Health	Laboratory Apprentice	5	4 @ 600
		1	@ 720
		1	@ 540
		1	@ 600
Psychiatric Institute	Laboratory Helper	4	1 @ 540
		1	@ 600
		1	@ 660
		1	@ 720

TABLE 9 gives the number of chemists and laboratory assistants at each rate of pay in the service of New York State, January 1, 1916.

TABLE 9—NUMBER OF CHEMISTS AND LABORATORY ASSISTANTS AT EACH RATE OF PAY IN THE SERVICE OF NEW YORK STATE, JANUARY 1, 1916

CHEMISTS			LABORATORY ASSISTANTS		
No.	Annual Salary	TOTAL SALARIES	No.	Annual Salary	TOTAL SALARIES
1	\$ 600	\$600	2	\$540	\$ 1080
1	800	800	5	600	3000
6	1200	7200	1	660	660
4	1400	5600	9	720	6480
2	1500	3000	3	900	2700
1	1600	1600	1	960	960
1	1680	1680	3	1200	3600
5	1800	9000			
1	1800(a)	1800	24		\$18480
3	2000	6000			
1	2400	2400			
1	2800	2800			
4	3000	12000			
1	3500	3500			
1	4000	4000			
1	4500(a)	4500			
34		\$66480			

(a) Basis daily wage, counting 300 working days to the year.

These tables show that the State of New York (omitting Public Service Commission, 1st District) is paying \$94,960 per annum for its personal service in chemistry.

Summarizing the data given for chemists in Table 9 and we arranging in terms of salary, numbers and percentages, re-obtain the following:

SALARY	NUMBER	PER CENT
\$ 600-1000	2	5.9
1001-1500	12	35.3
1501-2000	11	32.3
2001-2500	1	3.0
2501-3000	5	14.7
3001-4500	3	8.8
Total, 34		100.0

If, following the same method used in Section I, we regard \$3000 or over per annum as a fair measure of the "successful" chemist, we obtain:

	Below \$3000	\$3000 or over	TOTAL
Number.....	27	7	34
Per cent.....	79.4	20.6	100

TABLE 10 contains a summary of examinations in chemistry

TABLE 10—QUALIFICATIONS FOR APPOINTMENT AS CHEMISTS, NEW YORK STATE SERVICE

TITLE OF POSITION	OPEN TO	EDUCATION, TRAINING AND EXPERIENCE	CONTENT OF EXAMINATION AND RELATIVE WEIGHTS	SALARY
ANALYTICAL CHEMIST State Reservation Commission Saratoga Springs		<i>Required:</i> Thorough technical training in chemistry and practical experience in chemistry. Must have ability to make water analyses, bacteriological determinations, analyses of rocks, earth, minerals and metals; radioactivity determinations; calculation of carbonic acid gas content in mineral waters, analyses of paints, oils, enamels, asphalt, tiling, and other materials for flooring.	Written examination pertaining to duties of position, 1. Experience, 1.	\$1200
CHEMIST Public Service Commission	Non-residents	<i>Required:</i> Thorough technical training in chemistry and 5 years' experience; 3 years' training in technical school is equivalent to 1 year experience; must have experience in analysis of asphalt, coal tar, pitches, and mixed paint; also experience in analysis of steel, cast iron, cement, draw pigments, water, etc., is helpful.	Written examination pertaining to duties of position, 1. Experience, 1.	\$1801 to \$2100
CHEMIST Department of Highways		<i>Required:</i> Thorough technical training in chemistry; duties involve making and reporting on laboratory tests of oils, asphalts, tars, cements, sands, stone, etc., used for road building.	Elementary chemistry including physical chemistry, 10. Analytical chemistry, qualitative and quantitative analysis, 10. Chemistry of bitumens, 40. Chemistry of cements, 20. Training and experience, 20.	\$4 to \$6 per day
CHEMIST Department of Agriculture			Written examination with special reference to analysis of food and dairy products, 2. Education, experience and special qualifications, 1.	\$ 800 to \$1200
ASSISTANT CHEMIST Agricultural Experiment Station	Non-residents	<i>Required:</i> Graduation from college or university; special undergraduate training in agricultural chemistry and agricultural laboratory analysis; also post-graduate experience, either in chemical analysis of fertilizers and feeds or in agricultural chemical analysis of foods and dairy products.	Rated on training and experience.	\$ 960 to \$1200
ASSISTANT CHEMIST Public Service Commission	Non-residents	Must be graduate chemist with 2 years' practical experience.	Written examination including analyses of steel and cast iron, cement, asphalt, coal tar, pitches, mixed paints, dry pigments, water analyses, use of microscope and general chemistry, 1. Education and experience, 1.	\$1201 to \$1500
LABORATORY ASSISTANT State Department of Health	Men and women		Elementary chemistry, 1. Education and experience, 1.	\$720 to \$1200
PHYSIOLOGICAL CHEMIST State Department of Health	Men and women Non-residents Non-citizens	<i>Required:</i> Thorough knowledge of the principles of organic and physiological chemistry and 3 years' practical experience in physiological or biological chemistry.	Written examination on duties of position, 1. General and special training, practical experience and personal qualifications, 1.	\$1800 to \$2500
WATER ANALYST State Department of Health	Non-residents Non-citizens	<i>Required:</i> Thorough training in general chemistry with practical laboratory experience in water analysis.	General and sanitary chemistry and water analysis, 7; education and experience, 3.	\$720 to \$1200

of recent years, giving titles, qualifications, relative weights, content of examinations and weights of subjects, and salaries.

TABLE 11 shows the number of appointments to positions in chemistry, from competitive eligible lists, in New York State, during the years 1910-1915.

TABLE 11—APPOINTMENTS OF CHEMISTS, LABORATORY ASSISTANTS, ETC., FROM COMPETITIVE ELIGIBLE LISTS, NEW YORK STATE SERVICE 1910-1915

TITLE	1910	1911	1912	1913	1914	1915	Total
Chemist.....	2	2	..	5	..	..	9
Director of Laboratory.....	1	..	..	..	..	..	1
Laboratory Assistant.....	1	3	..	..	..	..	4
Technical Assistant.....	1	..	..	..	..	..	1
Water Analyst.....	2	..	..	..	..	..	2

TABLES 7, 8 and 9 were compiled from the Civil List of New York State of January 1, 1916; TABLE 10 from the examination announcements of recent years of the New York State Civil Service Commission; TABLE 11 from the Annual Reports of the same Commission.

III—THE CHEMIST IN THE SERVICE OF NEW YORK CITY

The statements which were made with regard to the Federal service and the service of New York State, apply also to the service of New York City; *viz.*, an employee's title is not always

a guarantee of the nature of his work and technical chemists only are here considered. We have included the Public Service Commission of the 1st District for the reasons stated in Section II.

TABLE 12 shows the number of chemists and laboratory assistants under each title in each City department and the total number for each title and for each department.

TABLE 13 gives the titles, numbers and individual salaries of chemists and laboratory assistants for the entire New York City service. TABLE 14 gives the number of chemists and laboratory assistants at each rate of pay in the service of New York City, June 30, 1916.

These tables show that the City of New York (including the Public Service Commission, 1st District) is paying \$200,786 per annum for its service in chemistry.

TITLE	Department of Education	Board of Estimate and Apportionment	Board of Water Supply	President, Borough of Manhattan	President, Borough of Brooklyn	President, Borough of Queens	Public Service Commission, 1st District	Department of Health	Department of Water Supply, Gas and Electricity	Fire Department	Bellevue and Allied Hospitals	Department of Public Charities	TOTALS
Assistant Chemist.....	..	..	..	1	1	..	10	..	..	..	..	1	13
Chemist and Bacteriologist.....	..	..	..	..	..	..	..	..	..	..	..	..	1
Chemist.....	1	8	1	1	1	1	11	5	..	..	..	..	27
Chief Chemist.....	..	..	..	..	..	..	..	..	..	..	..	..	1
Consulting Chemist.....	..	..	..	..	..	..	..	..	..	1	..	..	1
Director of Laboratory.....	1	..	..	..	..	..	..	..	..	..	..	..	1
Engineering Chemist.....	..	1	..	..	..	..	..	..	..	..	..	..	1
Fuel Engineering Chemist.....	6	..	..	..	..	..	..	..	..	..	..	..	6
Junior Chemist.....	..	..	..	..	2	1	..	..	..	..	..	..	12
Pathological Chemist.....	..	..	..	..	..	..	..	..	..	..	1	1	2
TOTAL.....	1	16	1	11	5	2	10	11	4	1	1	2	65
Laboratory Assistant.....	11	..	..	3	2	..	81	4	..	..	4	10	115

TABLE 13—CHEMISTS AND LABORATORY ASSISTANTS IN THE SERVICE OF THE CITY OF NEW YORK—JUNE 30, 1916

DEPARTMENT	CHEMISTS AS TITLED			LABORATORY ASSISTANTS	
	TITLE	No.	Salaries	No.	Salaries
DEPARTMENT OF EDUCATION					
Bureau of Supplies.....	Chemist	1	1 @ \$1200	..	..
DeWitt Clinton High School.....		..	..	1	1 @ \$1050
High School of Commerce.....		..	..	3	1 @ 950
				2	2 @ 1050
Evander Child's High School.....		..	..	1	1 @ 950
Manual Training High School.....		..	..	1	1 @ 1200
Erasmus Hall High School.....		..	..	1	1 @ 950
Commercial High School.....		..	..	1	1 @ 1000
Hunter College of the City of New York.....		..	..	2	1 @ 540
				1	1 @ 1250
Hunter College High School.....		..	..	1	1 @ 1300
BOARD OF ESTIMATE AND APPORTIONMENT					
Bureau of Contract Supervision, Central Testing Laboratory.....	Fuel Engineering Chemist	6	1 @ 1320	..	..
		2	2 @ 1500		
		2	2 @ 1800		
		1	1 @ 2100		
	Engineering Chemist	1	1 @ 1500		
	Chemist	8	1 @ 1350		
		7	7 @ 1800		
	Director of Laboratory	1	1 @ 6000		
BOARD OF WATER SUPPLY					
Engineering Headquarters.....	Chemist	1	1 @ 2700		
PRESIDENT, BOROUGH OF MANHATTAN					
Bureau of Highways.....	Chemist	1	1 @ 3500	3	1 @ 720
	Assistant Chemist	1	1 @ 1350	..	2 @ 900
	Junior Chemist	9	9 @ 1200		
PRESIDENT, BOROUGH OF BROOKLYN					
Bureau of Highways.....	Chemist	1	1 @ 2700	2	2 @ 900
	Assistant Chemist	1	1 @ 1500		
	Junior Chemist	2	2 @ 1260		
	Chemist and Bacteriologist	1	1 @ 1800	..	..
Bureau of Sewers.....					
PRESIDENT, BOROUGH OF QUEENS					
Bureau of Engineering Construction—Highways.....	Chemist	1	1 @ 2100	..	..
	Junior Chemist	1	1 @ 1200		
PUBLIC SERVICE COMMISSION—1ST DISTRICT					
Engineering Department—Material Inspection.....	Assistant Chemist	10	6 @ 1201	..	..
		3	3 @ 1350		
		1	1 @ 1500		
DEPARTMENT OF HEALTH					
Bureau of Food and Drugs.....	Chemist	11	5 @ 1260	6	5 @ 600
		2	2 @ 1500	1	1 @ 900
		3	3 @ 1800		
		1	1 @ 2400		
Office of the Auditor.....		..	..	2	1 @ 750
				1	1 @ 900
Research Laboratory.....		..	..	71	20 @ 600
				7	7 @ 660
				9	9 @ 720
				10	10 @ 750
				13	8 @ 840
				8	8 @ 900
				1	1 @ 960
				3	3 @ 1050
Kingston Avenue Hospital.....		..	..	1	1 @ 600
Tuberculosis Sanatorium, Otisville.....		..	..	1	1 @ 600
DEPARTMENT OF WATER SUPPLY, GAS AND ELECTRICITY					
Bureau of Water Supply—Laboratories.....	Chief Chemist	1	1 @ 3500	4	2 @ 900
	Assistant Chemist	3	1 @ 1380	2	2 @ 1050
		1	1 @ 1800		
		1	1 @ 2280		
FIRE DEPARTMENT					
Fire Prevention—Inspection.....	Consulting Chemist	1	1 @ 10 a day	..	..
BELLEVUE AND ALLIED HOSPITALS					
Pathological Department.....	Pathological Chemist	1	1 @ 2280	4	4 @ 750
DEPARTMENT OF PUBLIC CHARITIES					
Metropolitan Hospital.....	Chemist	1	1 @ 2940	1	1 @ 660
King's County Hospital.....	Pathological Chemist	1	1 @ 1500	4	2 @ 660
				2	2 @ 720
Cumberland Street Hospital.....		..	..	1	1 @ 780
City Hospital, Blackwell's Island.....		..	..	4	2 @ 660
				2	2 @ 900

TABLE 14—NUMBER AND SALARIES OF CHEMISTS AND LABORATORY ASSISTANTS IN THE EMPLOY OF NEW YORK CITY, JUNE 30, 1916

A—CHEMISTS			B—LABORATORY ASSISTANTS		
No.	Annual Salary	TOTAL SALARIES	No.	Annual Salary	TOTAL SALARIES
11	\$1200	\$13200	1	\$540	\$ 540
6	1201	7206	27	600	16200
7	1260	8820	12	660	7920
1	1320	1320	12	720	8640
5	1350	6750	15	750	11250
1	1380	1380	1	780	780
8	1500	12000	13	840	10920
14	1800	25200	18	900	16200
2	2100	4200	3	950	2850
2	2280	4560	1	960	960
1	2400	2400	1	1000	1000
2	2700	5400	8	1050	8400
1	2940	2940	1	1200	1200
1	3000(a)	3000	1	1250	1250
2	3500	7000	1	1300	1300
1	6000	6000			
65		111376	115		\$89410

(a) Basis daily wage, counting 300 working days to the year.

Summarizing the data given for chemists in TABLE 14 and re-arranging in terms of salary, numbers and percentages, we obtain the following:

SALARY	NUMBER	PER CENT
\$1000-1500	39	60.0
1501-2000	14	21.5
2001-2500	5	7.6
2501-3000	4	6.2
3001-6000	3	4.7
Total, 65		100.0

If, following the same method used in Sections I and II, we regard \$3000 or over per annum as a fair measure of the "successful" chemist, we obtain:

	Below \$3000	\$3000 or over	Total
Number.....	61	4	65
Per cent.....	93.7	6.3	100

The following quotation from the Thirty-second Annual Report of the Municipal Civil Service Commission of the City of New York (1915) is sufficient comment on these figures (*italics are the author's*).

"There are certain positions with which all Municipal Civil Service Commissions have had chronic difficulty. Conspicuous among these are the positions of alienist in City institutions, pathologists and pathologist-bacteriologist in laboratories and chemist in laboratories. *The great difficulty in these instances has been the lack of sufficient compensation to attract qualified candidates.* Examination after examination has been held, resulting either in no list or in the establishment of such an unsatisfactory list that those appointed had to be dropped and the Commission called upon to hold a new examination."

TABLE 15 contains a summary of examinations in chemistry in recent years, giving title, qualifications, relative weights, content of examinations and weights of subjects, and salaries.

TABLE 16 shows the number of appointments from competitive

TABLE 15—QUALIFICATIONS FOR APPOINTMENT AS CHEMISTS IN NEW YORK CITY SERVICE
Minimum Age 21, in Each Case

TITLE		EDUCATION, TRAINING AND EXPERIENCE	CONTENT OF EXAMINATION, AND RELATIVE WEIGHTS	SALARY
Chemist	Open to non-residents	<i>Required:</i> Knowledge gained by experience of general chemistry, principles of organic chemistry and quantitative analysis, including processes applicable to food examination; some credit given for ability to consult reference books in French and German, and for facility and accuracy in chemical computations.	Technical, 6; experience, 4.	\$1200
Chemist	Open to non-residents	Same as above, except qualitative analysis.	Technical, 6; experience, 4. Choice of special papers for the Health Department, for the Department of Water Supply, Gas and Electricity, and the Bureau of Highways.	\$1200 to \$1350
Chemist	Open to non-residents	Must have degree of B.S. or its equivalent, or 2 years' course in a technical school. Some credit given for ability to consult scientific journals in French and German.	Technical, 6; experience, 4. Technical examination divided into a paper in general chemistry, and special papers adapted to the needs of (1) the laboratory of the health department: the chemistry of foods, drugs, etc., (2) laboratories of the Bureaus of Highways, the testing of paving materials, (3) the laboratories of the commissioners of accounts; (4) fuel chemistry, (5) engineering chemistry.	\$1200 to \$1800
Chemist and Bacteriologist		<i>Required:</i> General knowledge in chemistry and ability to make qualitative and quantitative chemical tests and bacteriological tests of sewage and sewage effluents.	Experience, 4; technical, 6.	\$1800
Engineering Chemist	Physical exam. required	<i>Required:</i> A degree granted on completion of a standard course of instruction with chemistry as the major subject, and in addition, 1 year of experience in the practice of chemistry or other training and experience recognized by the Municipal Civil Service Commission as equivalent. Some credit given for ability to consult scientific journals in French and German.	Technical, 6; experience, 4; technical paper divided into two parts: general chemistry and engineering chemistry.	\$1500 to \$2100
Chemist, Food and Drugs	Physical exam. required	<i>Required:</i> A degree granted on completion of a standard course of instruction with chemistry as the major subject, or proof of other training and experience recognized by the Municipal Civil Service Commission as equivalent. Some credit given for ability to consult scientific journals in French and German.	Experience, 4; technical, 6; technical paper divided into two parts, general chemistry and the chemistry of food and drugs.	\$1200 to \$1500
Fuel Engineering Chemist	Non-residents admitted	Must be graduates of technical college. Some credit given for ability to consult scientific journals in French and German.	Technical, 6; experience, 4. Examination includes general chemistry and engineering chemistry.	\$1500 to \$1800
Junior Chemist (Asphalt)	Physical exam. required	<i>Required:</i> Training in qualitative and quantitative analysis, or practical experience in mixing asphalt with sufficient knowledge of qualitative and quantitative analysis to make the usual laboratory tests of asphalt.	Experience, 4; technical, 6.	\$1200
Pathological Chemist	Physical exam. required	<i>Required:</i> Degree of M.D. or Ph.D. or equivalent and in addition, at least 3 years' experience in original research work; consideration given to satisfactory evidence of successful management of a scientific laboratory or branch thereof.	Technical, 5; experience, 5. Reprints of original articles or precise reference to the publications must be submitted.	\$2500

eligible lists to positions in chemistry in New York City during the years 1908-1915.

TABLE 16—APPOINTMENTS OF CHEMISTS, LABORATORY ASSISTANTS, ETC., FROM COMPETITIVE ELIGIBLE LISTS, NEW YORK CITY SERVICE, 1908-1915

TITLE	1908	09	10	11	12	13	14	15	TOTAL
Assistant Chemist.....					1				1
Chemists.....	2	2	5	1					10
Food and Drugs.....							6		6
Asphalt, Jr.....							5	3	8
Asphalt, Jr., as Junior Chemist.....							1	1	2
Chemist & Bacteriologist.....						2			2
As Assistant Chemist.....						1			1
Chemist, Fuel Engineering.....					1	4			5
Chemist, Engineering.....					1		9		10
As Assistant Chemist.....							1	1	2
As Chemist.....							1	1	2
Chemist, Health.....						1	1		2
Chemist, Junior.....						1			1
Chemist (Sewage Disposal Methods).....							1		1
Fuel Engineer and Engineering Chemist.....					3				3
Laboratory Assistant.....	11		19						30
Laboratory Assistants:									
Chemical.....					1	6			7
Chemical (Female).....						1			1
Chemical (Male).....						2	5		7
Diagnostic.....					8	11			19
Diagnostic (Female).....							1		1
Diagnostic (Male).....							3	2	5
(Female).....	2		5						7
(Male).....	10		27						37
Research.....					4	6			10
Research (Female).....						5	7		12
Research (Male).....							5	4	9
Vaccine.....					3	3			6
Vaccine (Female).....								2	2
Pathologist, as Pathological Chemist.....						1			1
Pathological Chemist.....							1	1	2

TABLES 12, 13 and 14 were compiled from the Civil List of New York City for June 30, 1916; TABLE 15 from recent examination announcements of the Municipal Civil Service Commission of New York City; TABLE 16 from the Annual Reports of the same Commission.

IV—THE STANDARDIZATION OF EMPLOYMENTS IN CHEMISTRY IN THE PUBLIC SERVICE

Until quite recently, the salaries of employees in the public service have been determined in a haphazard manner. In

many instances salaries have been fixed by accident, expediency or political preferment rather than by any consideration of the nature of the work performed or of the service rendered. This state of things has been unfortunate, to say the least. It has led to the squandering of money, to inefficiency of service, to the disgruntlement of many of the employees and, in some instances, to the disruption of that loyal *esprit de corps* so essential to the smooth running of a large organization.

Of late, there have been several attempts to improve these highly undesirable conditions, by an endeavor to standardize public employments. The standardization movement has as its primary objects:¹

(1) The establishment of a basis for fixing salary rates in relation to work values.

(2) The establishment of standard factors of education or experience for each class and grade of employment prescribing conditions which must be met by persons preliminary to appointment.

(3) The establishment of standard titles and work requirements for each class and grade of employment prescribing conditions which must be met or conformed to after appointment.

(4) The establishment of standards to govern promotions, transfers and other subjects of employment control.

(5) The establishment of a formal procedure which shall currently inform the public and the official organization of conditions governing entrance to the public service and advancement therein.

As these matters are at present under discussion, and as they are likely to be acted upon in the near future, it has been deemed advisable to bring together such comparative data as bear on the problem in so far as chemists are concerned.

¹ Municipal Research No. 67, page 17.

TABLE 17—STANDARD SPECIFICATIONS FOR POSITIONS IN CHEMISTRY PROPOSED BY THE COMMITTEE ON CIVIL SERVICE OF THE SENATE OF THE STATE OF NEW YORK

PROPOSED CLASSIFICATION, BASED UPON DUTIES AND WORK REQUIREMENTS: STANDARD TITLES AND RATES

DEFINITION GROUP	GRADE	TITLE	RATES	EXISTING AUTHORIZED POSITIONS(a)	RATES
TECHNICAL ASSISTANT	I	The duties of the incumbents of these positions are to perform, under supervision the technical duties for which they have qualified, in the routine and research work of a pathological, bacteriological, serological or chemical laboratory.	<i>Technical Assistant</i> \$ 600 660 720 840 960 1020	Technical Assistant Technical Assistant Technical Assistant Technical Assistant	\$ 540 600 660 900
CHEMIST	I	The duties of incumbents of these positions are to make under supervision, routine chemical analyses or tests of an ordinary character, to perform definite details of difficult analyses or tests, and to conduct research work within this field.	<i>Junior Chemist</i> 1080 1200 1320	Assistant Chemist Assistant Inspector of Gas Chemist Chemist Chemist, part time	800 1200 800 1200 1200
	II	The duties of incumbents of these positions, which may involve supervision of employees in Grade I, are to assume responsibility for a division of chemical work in an important laboratory, and to make difficult chemical analyses and tests.	<i>Assistant Chemist</i> 1440 <i>Chemist</i> 1560 or 1680 <i>Assistant Physiological Chemist</i> 1800	Chemist Chemist Chemist Chemist Water Analyst Water Analyst Physiological Chemist	600 1680 1800 2000 1600 1800 1500
	III	The duties of incumbents of these positions, which require the highest degree of skill and judgment in the practice of chemistry, are to direct and be responsible for the work of a small laboratory, or to initiate, conduct and supervise difficult chemical research work.	<i>Chemist</i> 1980 or 2160 <i>Physiological Chemist</i> 2340 2580 2820 3060 3300 3540	Chemist Chemist Chemist Chief Chemist Sanitary Chemist Water Analyst Water Analyst Physiological Chemist	2400 2800 3000 3000 2800 1600 1800 2500
	IV	The duties of the incumbent of this position which involves the application of advanced scientific technique and research methods, are to undertake the solution of biological-chemical problems in their relation to disease and to supervise and be entirely responsible for the work in a particular field of research of an important laboratory.	<i>Biological Chemist</i> 3300 3600 3900 4200 4500	Chemist	3000

(a) Existing titles and rates are shown opposite proposed grades in which they were classified after appraisal.

TABLE 17 contains the standard specifications¹ for chemists proposed by the Committee on Civil Service of the Senate of the State of New York transmitted to the Legislature, March 27, 1916.

TABLE 18 contains the standard specifications² for chemists

TABLE 18—STANDARD SPECIFICATIONS FOR CHEMISTS PROPOSED BY THE BUREAU OF STANDARDS OF NEW YORK CITY

GRADE	SALARIES (DOLLARS)
I Junior Chemist.....	900 1020 1140 1260 1380
II Assistant Chemist (full time)	1500 1620 1740 1920 2100
Assistant Chemist (not less than 18 hrs. a wk.).....	1020 1140 1260 1380
III Chemist.....	2280 2400 2700 2940 3180 3420 3660
IV Director (Central Testing Laboratory).....	5100 5520 5940
(No recommendation above \$5940)	
I Laboratory Assistant.....	600 720 840 960 1080 1200 ..
(With or without maintenance: no rate with maintenance above \$960)	

proposed by the Bureau of Standards of the Board of Estimate and Apportionment of the City of New York, June, 1916.

TABLE 19—COMPARATIVE STANDARDIZATION DATA—CITIES OTHER THAN NEW YORK

TITLES—Chemist:	CHICAGO Rates	TITLES	PITTSBURGH Rates	TITLES	PORTLAND Rates	ST. PAUL Rates
Junior Sanitary.....	1200 1320 1440 ..	Junior Chemist	1020 1080 1140 1200	Asst. Milk Chemist	1020 1080 1140 1200 1260 1320	
Senior Sanitary.....	1620 1740 1860 ..	Chemist.....	1350 1500 1650 1800	Milk Chemist.....	1680 1740 1800 1920 2040 2160	
Principal Sanitary.....	1980 2100 2280 2520	Chief Chemist..	2100 2400 2700 3000			
LABORATORY ASSISTANT:	780 840 900 960		780 840 900 960		780 840 900 960 1020 1200 600 660 720	

TABLE 20—COMPARATIVE SALARY DATA FROM MUNICIPAL PAYROLLS—1916

SERVICE POSITION AND CITY	CHEMIST					LABORATORY ASSISTANT				
	MINIMUM No. Rate	Most Frequent No. Rate	Intermediate No. Rate	MAXIMUM No. Rate	TOTAL	MINIMUM No. Rate	Most Frequent No. Rate	Intermediate No. Rate	MAXIMUM No. Rate	TOTAL
Philadelphia.....	2 960	1 1300	1 1500	3 2000	7	5 600	1 660	1 720	1 800	3 900
Boston.....	1 1900	..	..	1 1900	1	1 600	..	..	1 600	1
Cleveland.....	1 1200	1 1500	..	1 2000	3	1 360	2 600	..	1 720	4
Baltimore.....	1 720	1 800	1 960	1 1200	2 1500	2 240	1 400	3 720	3 780	1 900
Pittsburgh.....	2 1200	2 1500	1 1800	1 2400	6	1 720	2 780	4 900	..	2 1080
Buffalo.....	1 1800	..	..	1 1800	1	1 720	1 1087.40	1 1200	..	1 1300
San Francisco.....	2 1500	..	..	1 1800	3	1 720	1 900	..	..	1 1500
Milwaukee.....	1 1000	1 1500	..	2 1800	4	1 720	..	..	1 750	2
Cincinnati.....	1 900	..	..	1 1800	2	1 600	..	..	1 600	1
Los Angeles.....	1 1500	..	..	1 1800	2	..	..	..	..	..
Minneapolis.....	2 1500	..	..	1 1800	3	1 300	2 720	..	1 780	4

(a) Two (2) others at rates not given.

TABLE 19 contains comparative standardization data compiled from the standards³ proposed in the cities of Chicago, Pittsburgh, St. Paul and Portland.

¹ First Report of the Committee on Civil Service of the Senate of the State of New York appointed to investigate the Civil Service of the State, with particular reference to salaries, grades and duties of officers and employees—transmitted to the legislature, March 27, 1916.

² Standard Specifications for Personal Service, prepared by The Bureau of Standards for the Board of Estimate and Apportionment of the City of New York, June, 1916.

³ See Comparative Salary Data—Philadelphia Bureau of Municipal Research, March 1, 1916.

TABLE 20 contains data of the salaries of chemists employed at present in typical American cities. This is inserted for purposes of comparison.

If the members of the American Chemical Society are to have any voice in the determination of the compensations of those of their number who are employed in the public service, now is the time for them to express themselves. These matters are under discussion at the present moment. If our profession is to let itself be heard in tones of no uncertain meaning, it is imperative that we adopt one of the most popular expressions of the day—"Do It Now!" Here is a field of immediate usefulness for the Committee on Status and Compensation which has been proposed above.

In their negotiation with governmental authorities the members of this Committee should remember that standardization without representation is tyranny. Furthermore, faint chemist ne'er won fair salary and none but the brave deserve the fair.

Whether or not positions of high grade, involving initiative and individuality should be standardized at all is open to question, to say the least.

SUMMARY AND CONCLUSIONS

Having the facts before us, we are in a position to summarize and to draw conclusions.

If we combine the numbers of chemists employed by the United States Government, the Government of New York State and the Government of New York City, we find that we have 815 positions which may be regarded as attractive to the

graduate in chemistry. From the view-point of compensation, these are distributed as follows:

SALARIES	FEDERAL	NEW YORK State	NEW YORK City	TOTAL No.	Per Cent
\$500 to 1000	23	2	..	25	3.1
1001 to 1500	189	12	39	240	29.4
1501 to 2000	219	11	14	244	30.0
2001 to 2500	159	1	5	165	20.2
2501 to 3000	93	5	4	102	12.5
3001 to 3500	13	1	2	16	2.0
3501 to 4000	12	1	..	13	1.6
4001 to 4500	1	1	..	2	0.2
4501 to 5000	7	..	..	7	0.9
5001 to 6000	..	..	1	1	0.1
Total, 716	34	65	815	100.0	

If we adopt \$3000 or over per annum as a fair measure of the "successful" chemist, we find the following:

	Below \$3000	\$3000 or over	TOTAL
Number.....	727	88	815
Per cent.....	89.2	10.8	100

This bare statement of figures constitutes a revelation, the implications of which are so obvious that it would be an insult to the intelligence of this audience to repeat them.

Let us turn aside from compensations a moment, to focus our attention on the question of the *numbers* of chemists in governmental employ.

The total numbers of employees in the branches of the public service which we have considered in detail (*i. e.*, the United States Government, New York State and New York City) are in round numbers:

United States.....	480,000
New York State (excluding Public Service Commission, 1st District).....	18,000
New York City (including Public Service Commission, 1st District).....	85,000
Total.....	583,000

Of the total number of positions in these services, the chemists constitute 0.15 per cent for the United States, 0.19 per cent for New York State, and 0.08 per cent for New York City. Of the total number in the three services (583,000) the chemists (815 in number) constitute 0.14 per cent.

Mr. J. L. Jacobs¹ has recently estimated that the total number of civil employees in the United States (including the Federal Government, States and Cities) is 1,800,000 to 2,000,000. If the average just stated is roughly indicative of the general proportion of chemists in all these services, there are probably about 2800 chemists who are employed in public service. If we add to these, those who are dependent on them, we find that the part of our population involved in the subject matter of this paper is about 11,200, counting 4 to a family.

Again, the conclusions are obvious. The insignificance of the proportion of chemists in public service is wholly at variance with the importance of their work of regulation, enforcement, conservation and creation.

In our introduction, we pictured the young chemistry graduate in a questioning mood with regard to the usual prospects of his profession, its compensations and rewards. To these questions others were added: *Is there a career in the public service? What are the relative advantages and disadvantages? Is public service in chemistry a useful stepping stone? And so on.* The facts before us should aid us in answering such questions.

In the first place, we may count security as one of the most obvious of the advantages. The average chemist, like the average engineer, is proverbially a job chaser. The special committee of the American Society of Civil Engineers "to investigate the conditions of employment and of compensation of civil engineers," by the way, has set as one of its tasks "to secure information indicating the proportion of time when engineers

are out of employment." Should a similar committee be created in the American Chemical Society, as suggested above, this line of activity is one of its legitimate functions.

As contrasted with the depressing picture of the average chemist, roving over the earth in search of a job, public service offers the one great advantage of *security*. Permanency of tenure is usually assured. On the other hand, this very security may become a disadvantage. Security is apt to breed indolence. Many a good man has degenerated into a mere job holder in public service, who, if he had had the spur of necessity to urge him on, would have been more successful.¹

There are other advantages to be considered. The lower grades of chemical work are better paid in government service than in private practice. Furthermore, compensation conditions are improving. A comparison of the rates of pay to-day with those which existed 10 years ago² will make this apparent. If it is true that the salaries in government service are rather better, on the average, in the beginning, it is equally true, on the other hand, that they are poorer later on. The numbers of high-paying positions in government service are few. As has been stated above, only 10.8 per cent of the chemical positions in the service of the Federal Government, New York State and New York City pay \$3000 or over per annum.

From the standpoint of the value of the experience to be gained by the chemist in public service, it is quite natural to find a condition prevails which is precisely analogous to that of compensation. The experience of the young chemist in his first years of governmental service is most valuable. But, as the years go on, along with a static salary, we find a routine character of work which frequently kills off any initial creative ability of the employee.

Of this state of things, there is but one interpretation possible. Taking it all in all, *public service in chemistry is a good stepping stone but a poor career.* We believe that most chemists are agreed on this point.

May I be permitted one final word of a somewhat more general nature?

The Council of the American Chemical Society, at its meeting of September 27, 1916, unanimously passed the following resolution:

"*Resolved*, That the Council of the American Chemical Society declares itself to be in favor of an adequate system of national defense. Such a system involving our Army, Navy, coast defenses, natural resources and industrial development, should be so designed as to maintain our liberty and preserve our peaceful pursuit of happiness. The system should also be designed with such reserve power as to maintain our honor and integrity, should the same be menaced by foes within or without. To that end we hold ourselves in readiness to serve our Country in any capacity, but especially in such ways as our abilities best qualify us."

American chemists can devote themselves to no nobler purpose than to the carrying out of the splendid spirit of this resolution. But such devoted action will not achieve its full function, unless we add to the elements of preparedness enumerated in the resolution, another of at least equal importance—*civil preparedness*. No amount of military, naval and industrial preparedness can be effectual unless we have backing it up an army of civil servants disciplined to carry out the administrative needs of the government. If our democracy is to survive, we must discard the haphazard, trust-to-luck methods of the past.

Whatever one's sympathies in the present European conflict may be, one thing is certain—*Germany has been efficient.* And this efficiency has expressed itself as greatly in its civil administration as on the field of battle. Let me quote a passage from

¹ This whole question of "success" ought to be gone into more thoroughly than the limits of this paper will permit. What is a "success?"

² See *Bull. 94*, Bureau of the Census, p. 123.

¹ "Public Service Opportunity and Preparedness," *Journal of the Western Society of Engineers*, No. 6, June, 1916.

a paper by the speaker who immediately preceded me. He says:¹

"On reviewing the remarkable achievements of Germany in the land campaigns, even the most grudging cannot withhold their admiration for the effectiveness and scientific precision with which her gigantic military enterprises are carried out. There is no doubt that the wonderful showing made by that country has been due to something more than the valor and skill of the soldiers on the battlefield. The military authorities would have been impotent if it had not been for the masterful way in which the civil administration of the country has been conducted. If Germany had back of the firing line the kind of civil government which the United States had during the Spanish war—with its scandals of "embalmed" beef and inadequate supplies—administrative imbecility would have wrought more terrible havoc among her own men than all the high-power explosives which the Allies have mustered."

To any one who has given the least thought to this subject, several things are clearly apparent. In the first place, the United States can no longer afford to ignore the lessons to be learned from the experience of other nations. We cannot sit idly by, like immature children, smugly satisfied that democracy and inefficiency are inseparable.

This country is about to go through a second period of reconstruction. Though we have not thus far been in arms in the present world war, our economic interests have been so directly involved, that complete readjustment will be needed at its close. The new conditions which will prevail in Europe will also add to our difficulties. In adapting ourselves to this reconstruction period, our whole scheme of civil service procedure has to be radically revised. To date, we have looked upon our civil service problems in too negative a way. The old slogan "Keep the rascals out of office" will have to be modified to read "Get the best men *into* office and having got them there, keep them there." The old-fashioned politician—one of the worst of our enemies from within—has to be relegated to the realm of the past along with the ichthyosaurus and the dodo. The new-fashioned office-holder must be of good natural ability, trained for his work and efficient in its performance. He must be assured of a square deal. Nothing is more deadening to an earnest worker than a system which places political subserviency above proved devotion and efficiency. Public service must be made a life-career of dignity with recognition of merit as its impelling force and adequate financial return as its tangible reward.

The fear has been expressed that in this manner a "privileged class" will be built up. It is significant that those who are loudest in their protestations in this regard are the very politicians who in themselves constitute a bureaucracy of the most pernicious sort—a bureaucracy of the unscrupulous, the untrained and the unfit. The one thing in the United States which stands forth as the highest expression of a true and thorough-going democracy is our system of free education extending from the kindergarten through the college and, in some instances, through the university. If our free democratic system of education is to reap its fullest harvest, surely the graduates of a free public school, a free high school and a free college or university, who have received specific training in the work they are to perform, are to be regarded as ideal material for building up a democratic administration which will dispel this favorite bugaboo—this "privileged class"—of the cheap politician.

But before we can attain these highly desirable ends, it is essential, as a preliminary step, to make a complete survey of the entire field of public service as it exists at present.² Each vocation and profession must be studied in turn and its relationship to the whole established. The task is a big one. It

¹ Charles A. Beard, *Annals of the American Academy of Political and Social Science*, Vol. LXIV, March, 1916.

² For a survey of the municipal civil service of New York City, see *Municipal Research No. 68*.

involves painstaking application and a reverence for fact to the exclusion of fancy.

Having, in this manner, determined the needs of our public service, our colleges, universities, and technical schools must be called upon—*must* is the word I want to use—to train men for our civil service just as West Point and Annapolis train them for our military and naval services.

Of these larger aspects of the questions involved, this paper cannot treat. It does attempt, however, to present a survey of a very small corner of a very large field.

THE COLLEGE OF THE CITY OF NEW YORK

THE CHEMIST IN THE SERVICE OF THE CITY OF NEW YORK

By OTTO H. KLEIN

The city of New York is well on its way towards becoming the greatest and wealthiest city in the world. In and about it are a score of prominent colleges and universities, in each of which thorough courses in chemistry are well attended, resulting in the graduation each year of an ample supply of well equipped chemists. Additionally, a large number of chemists can at all times be found, from every part of the United States, who are not only willing and anxious to secure employment in New York City, but who are also willing to make a considerable sacrifice in salary for the object of coming to New York. It is evident therefore that no scarcity of chemists, and it may be added very good chemists, exists in this city, and that the city should have a waiting list of very desirable eligibles, from which to recruit its chemical staff.

Withal, up to the present, the competition for employment in the city's laboratories has been characterized by apathy rather than keenness, and while in spite of this fact the personnel of the city's roll of chemists has been maintained at a fairly high standard, this condition has been practically fortuitous rather than the necessary result of deliberate plan.

Recognizing this fact, and with the purpose of stimulating competition among chemists for employment by the city, the Bureau of Standards has formulated a system of specifications which, if finally adopted, should have the effect of attracting the ablest chemists available to the ranks of the city's workers, which is as it should be, the best being none too good for the great work that the city is carrying on. Details of the salary grades have been presented in other publications, and have been referred to by Professor Breithut in his able exposition; *en passant* it is a matter of duty to call attention to the untiring efforts of this gentleman in connection with the betterment of the chemists' compensation, and to the debt that the municipal chemists owe him therefor. The Bureau of Standards specifications, in effect, call for definite entrance salaries in the various grades, and a well balanced and adequate system of increases for meritorious service, both features hitherto having been unsatisfactorily vague and indefinite, and having therefore contributed to rendering municipal employment unpopular among chemists.

WORK OF CITY LABORATORIES

The work of the various laboratories maintained by the city may be roughly divided into two categories: that of protecting the city's purse, and that of protecting the city's health. The water and food supply of the city is ever the source of problems requiring the best efforts of the sanitary chemist upon the one hand, and the examination of the hundreds of different types of materials purchased by the city in carrying on its various activities gives employment to chemists who are capable, in brief, of doing any sort of work that a chemist is ever called upon to do.

Space forbids an enumeration of the different sorts of analyt-