

Formal Education in Sanitary Science

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THE ORDER of the sums of money spent on sanitation programs and the number of professional sanitarians engaged in the programs are two indexes of the importance which should be attached to the education of this group of public health workers.

Expenditures by State health departments and other State agencies on identifiable sanitation services in 1950 were \$22,413,000 (1) or about \$0.15 per capita. The amount spent by local health agencies, unofficial health groups, and private interests in the promotion of health by improving or modifying environmental conditions is unknown, but it would increase this figure materially.

The operation of sanitation programs involves the use of different kinds of professional and auxiliary employees. The Report of Local Public Health Resources (2) indicates that 3,723 professional sanitarians were employed in 1951 by official health agencies in local areas with full-time health organizations (which cover about one-half the counties and three-fourths of the population in the United States). The report counted as professional sanitarians only those who were professionally trained as public health sanitarians, food technologists, dairy scientists, chemists, entomologists, and for similar vocations. Other sanitation per-

sonnel, both of other professions and their auxiliaries, numbered 3,295. Data in this report permit an estimate that 1,056 more professional sanitarians were needed by the local health organizations studied to meet the recommended staffing requirements. The 3,723 professional sanitarians employed added to the 1,056 estimated to be needed total 4,779. This total, like the expenditures total, would be increased, of course, if we were to add the professional sanitarians employed, and those needed to meet a specific staffing pattern, by State health groups working at the State level (as opposed to State-employed workers engaged in health work in local areas) and those of unofficial health organizations and of private interests.

Sanitary Science Basic

To accomplish improvement and modification of the environment to the benefit of health at the least cost, sanitarians need a sound and thorough knowledge of sanitary science. Those whose basic education includes instruction in the biological sciences are better prepared to acquire a working knowledge of sanitary science through the process of field training than are others. Chemists, bacteriologists, and entomologists have had the advantage of undergraduate instruction in one or more biological sciences. Similarly, those who have concentrated on sanitary science in their undergraduate studies have received a grounding in the biological sciences. This need will influence

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Table 1. Certain characteristics of undergraduate education in sanitary science (sanitation) in the United States, by institution

Institution	Organizational entity having responsibility	Title of		Degree currently awarded	Academic year curriculum initiated
		Curriculum	Option		
California, University of—Berkeley.	School of Public Health.....	Public health.	Sanitation..	B.S.....	1946-47
California, University of—Los Angeles.	Department of public health, School of Public Health.	do.....	do.....	B.S.....	1947-48
Denver, University of.	Division of science, College of Arts and Sciences.	Sanitary science.	.....	B.S.....	1948-49
Florida State University.	Department of health education, School of Education.	Sanitation..	.....	B.S. (sanitation)	1950-51
Indiana University....	Department of public health, School of Medicine.	Public health.	.....	B.S. (public health).	1946-47
Massachusetts, University of.	Department of bacteriology and public health, School of Arts and Sciences.	do.....	.....	B.S.....	1945-46
Michigan, University of.	School of Public Health.....	Sanitary science.	.....	B.S. in public health.	1950-51
New York University: Day division.....	Department of civil engineering, College of Engineering.	do.....	.....	B.S. (sanitary science).	1950-51
Evening division ¹	do.....	do.....	.....	do.....	1950-51
North Carolina, University of.	College of Arts and Sciences..	Public health.	Physical sciences and public health.	B.S. (public health).	1940-41
Oklahoma, University of.	Department of public health, College of Arts and Sciences.	Public health and sanitation.	.....	B.S.....	1949-50
Rutgers University....	College of Arts and Sciences..	Sanitary science.	.....	B.S. (sanitary science).	1917-18
San Jose State College..	Natural science department...	Sanitation..	.....	B.A. (major in sanitation).	1949-50
Tulane University of Louisiana.	Department of zoology.....	.....	Sanitarian program.	B.S.....	1952-53
Utah State Agriculture College.	Department of bacteriology and public health, School of Arts and Sciences.	Public health major.	.....	B.S.....	² 1935-36
Washington, State College of.	Department of bacteriology and public health, division of biological sciences, College of Sciences and Arts.	.....	Sanitary science.	B.S. (bacteriology and public health).	1936-37
Washington, University of.	Department of public health and preventive medicine, School of Medicine, College of Arts and Sciences.	Public health.	do.....	B.S. (major in public health).	1947-48

¹ In this division, this curriculum normally takes more than 4 years to complete.

² Estimated.

the pattern of education made available to the future undergraduate student in sanitary science by the colleges and universities electing to engage in this area of education.

Although workers from many professional categories are applying themselves to environmental health problems in this country, the bulk of them are sanitary engineers and sani-

tarians. Considerable information regarding sanitary engineers—their rate of graduation at various degree levels (3) and their distribution—is available, but corresponding information has not been available on professional sanitarians whose basic university education was in sanitary science.

The concept selected as the base upon which to obtain relevant data is expressed in a standard definition. Webster defines the sanitarian as “an advocate of sanitary measures; one especially interested or versed in sanitary measures or specifically making a profession of the application of such measures for the public

benefit.” An advocate of sanitary measures should be well versed in sanitary science and should, therefore, in the process of seeking undergraduate or graduate study, gravitate to institutions prepared to offer the opportunity for major concentration in sanitary science.

Since little has been known about the relationship between undergraduate and graduate instruction in sanitary science, data were collected first for undergraduate work during the early months of 1953 and then for graduate work in June and July 1953. Several professors of sanitary science provided considerable assistance during the course of choosing items

Table 2. Certain characteristics of graduate education in sanitary science (sanitation) in the United States, by institution

Institution	Degrees currently awarded	Organizational entity having responsibility	Academic year in which work was initiated
California, University of—Berkeley.	M.P.H.-----	School of Public Health-----	1946-47
Columbia University-----	M.S. in sanitary science-----	Division of sanitary science, School of Public Health.	1949-50
Massachusetts, University of-----	M.S.-----	Department of bacteriology and public health.	1946-47
Michigan, University of-----	M.P.H.-----	School of Public Health-----	1934-35
	Ph.D. or Sc. D. in sanitary science.	School of Graduate Studies-----	1948-49
Minnesota, University of ¹ -----	M.P.H.-----	School of Public Health-----	1946-47
	M.S.-----	Graduate School-----	}1946-47
	Ph.D.-----	do-----	
New York University-----	M.S. in sanitary science-----	Graduate division, College of Engineering.	1947-48
	Ph.D. (sanitary science major).	Graduate division, College of Engineering and Graduate School, College of Arts and Science.	1951-52
North Carolina, University of-----	M.S.P.H.-----	}Department of sanitary engineering, School of Public Health.	}1939-40
	M.P.H.-----			1947-48
Oklahoma, University of-----	M.S. in public health-----	Graduate College and department of public health.	}1950-51
	Ph.D.-----	Graduate College and School of Medicine.	
Puerto Rico, University of-----	Master in sanitary science--	Department of preventive medicine and public health.	1941-42
Rutgers University-----	M.S.-----	Department of sanitation, College of Agriculture.	}1923-24
	Ph.D.-----	do-----	
Tulane University of Louisiana--	M.P.H.-----	Department of tropical medicine and public health, School of Medicine.	}1951-52
	Dr.P.H.-----	do-----	

¹ Data in this table and table 5 pertain only to sanitation personnel who do not hold a degree in engineering.

to be included in the inquiry and in preparing an inquiry response sheet designed to get the most informative replies.

Inquiries regarding the institutions to be included in the two surveys were made in several directions, and the summaries are believed to be complete (tables 1 and 2). However, some institutions warranting inclusion may not have been addressed. They should be added at a subsequent review of these data.

Course of Study

The distribution of the undergraduate students' time in seven broad instruction groups is shown for each institution in table 3. These groups were selected as being the most suitable for the purposes of this survey. Course subjects were allocated to the groups after consultation with representative teachers of sanitary science, and although there was not complete agreement as a result of the consultations, the

weight of opinion favored the following selections:

Natural science and mathematics. Astronomy; chemistry; geology; mathematics; metallurgy; meteorology; physics.

Biological science. Biology; anatomy; bacteriology; microbiology; biochemistry; botany; entomology; genetics; physiology; zoology.

Social science. Anthropology; archaeology; economics; ethnology; geography; history; foreign affairs; political science; psychology; public administration; social work; sociology; statistics.

Engineering. Aeronautical engineering; agricultural, architectural, ceramic, chemical, civil, electrical, general, geological, industrial, mechanical and metallurgical engineering; engineering mechanics and physics; mining, marine, petroleum, sanitary, and textile engineering; naval architecture.

Medical science and health professions. Sanitation; sanitation practice; public health; mental hygiene; epidemiology; nutrition; sanitary (applied) chemistry; public health (specialized) statistics; public health (specialized) administration; public health law.

Humanities. Religion; English and foreign lan-

Table 3. Semester hours required for graduation and distribution of time in 4-year undergraduate sanitary science curriculums in the United States, by institution

Institution	Minimum number semester hours required for graduation	Percent of time allotted to course groups						
		Natural science and mathematics	Biological science	Social science	Engineering	Medical science and health professions	Humanities	Other
California, University of—Berkeley..	120	18	14	18	0	38	3	9
California, University of—Los Angeles..	128	20.3	14.8	25	3.9	23.4	6.3	6.3
Denver, University of ¹	124	22.2	25	19.4	3.4	22.2	5.5	1.6
Florida State University.....	124	19	27	13	0	14	17	10
Indiana University.....	124	19.38	15.5	13.18	1.55	24.81	10.85	14.73
Massachusetts, University of.....	120	15	28	10	7	20	15	5
Michigan, University of.....	130	27	16	13	6	29	9	0
New York University:								
Day division.....	150	27.3	9.3	10.7	25.3	8.7	13.4	5.3
Evening division.....	142	28.9	9.8	11.2	26.8	9.2	14.1	0
North Carolina, University of.....	135	32	11	13	15	11.5	15	2.5
Oklahoma, University of.....	123	20	20	13	6	25	11	5
Rutgers University ²	147	26.52	32.64	8.16	0	4.08	20.4	8.16
San Jose State College.....	124	23	21	24	5	16	9	2
Tulane University of Louisiana.....	146	25	27	15	0	12	16	5
Utah State Agricultural College ³	124	12.36	23.11	5.38	0	19.89	10.21	29.05
Washington, State College of.....	128	20	25	10	8	25	5	7
Washington, University of ⁴	142	22	11	10	7	23	4	23

¹ Percentage of time allotted totals 99.3.

² Percentage of time allotted totals 99.96.

³ ⁴ Percentages of time allotted are not comparable to the others because the figure for "Other" includes 25.82 percent and 14 percent, respectively, of "electives."

Table 4. Number of graduates from undergraduate sanitary science (sanitation) curriculums in the United States, 1931-53

Institution	Total	Academic year ¹								
		1931	1933	1936	1937	1938	1939	1940	1941	1943
Total.....	474	0	1	0	1	6	7	8	3	4
California, University of—Berkeley.....	90									
California, University of—Los Angeles.....	89									
Denver, University of.....	65									
Florida State University.....	3									
Indiana University.....	36									
Massachusetts, University of.....	44									
Michigan, University of.....	5									
New York University.....	0									
North Carolina, University of.....	5								0	2
Oklahoma, University of.....	18									
Rutgers University ²	18	0	1	0	0	1	3	2	1	2
San Jose State College.....	14									
Tulane University of Louisiana.....	0									
Utah State Agricultural College.....	⁴ 23			³ 0	³ 1	³ 2	2	3	³ 1	0
Washington, State College of.....	42				0	³ 3	³ 2	³ 3	³ 1	0
Washington, University of.....	⁴ 22									

Institution	Academic year ¹									
	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953
Total.....	2	1	1	3	19	53	101	100	87	77
California, University of—Berkeley.....				0	5	5	20	22	23	15
California, University of—Los Angeles.....					4	11	13	23	17	21
Denver, University of.....						14	19	21	7	4
Florida State University.....								1	0	2
Indiana University.....				0	0	5	6	7	10	8
Massachusetts, University of.....			0	0	0	7	18	7	6	6
Michigan, University of.....								0	1	4
New York University.....								0	0	0
North Carolina, University of.....	1	1	0	0	0	1	0	0	0	0
Oklahoma, University of.....							3	5	6	4
Rutgers University ²	1	0	0	0	1	1	4	0	1	0
San Jose State College.....							4	4	4	2
Tulane University of Louisiana.....										0
Utah State Agricultural College.....	0	0	³ 0	³ 2	³ 2	1	⁴ 4	1	2	2
Washington, State College of.....	0	0	1	1	5	4	6	5	6	5
Washington, University of.....					2	4	4	4	4	⁴ 4

¹ The academic year is defined as the 12-month period prior to the close of the spring session, which is in June at most colleges and universities. No degrees were awarded in the years omitted from the table.

² Figures for the academic years 1917-18 through 1929-30 are not available, but it has been estimated

by T. J. Murray that there was about one graduate per year during that 13-year period. These estimated figures have not been included in the totals.

³ Estimated.

⁴ Includes 1 non-United States national.

guages; journalism; literature; architecture; music; speech and dramatic arts; philosophy.

Other. Military science; physical education.

Table 4 shows that 15 colleges and universities have had 474 graduates from undergraduate sanitary science curriculums in the 23-year

period covered. Of these graduates, 418, or 88 percent, finished their work in the last 5 years (1949-53).

A total of 425 completed graduate work in sanitary science in the 28 years reported upon. Of these 407 were at the master's level (table 5).

Table 5. Number of graduates from graduate sanitary science (sanitation) courses in the United States, 1926-53

Academic year ¹	Master's degree level												Doctor's degree level
	Total	California, University of	Columbia University	Massachusetts, University of	Michigan, University of	Minnesota, University of	New York University	North Carolina, University of	Oklahoma, University of	Puerto Rico, University of	Rutgers University	Tulane University of Louisiana		Rutgers University
Total	407	33	² 17	51	78	11	13	68	24	70	³ 37	5	18
1926	1										1		0
1928	0										0		1
1929	2										2		0
1930	1										1		0
1932	1										1		1
1933	3										³ 3		0
1935	3				1						2		1
1936	2				1						1		0
1937	2				1						1		0
1938	5				5						0		1
1939	6				5						1		3
1940	7				7			0			0		0
1941	8				6			1			1		0
1942	15				3			3		9	0		0
1943	1				1			0		0	0		0
1944	12				0			0		11	1		0
1945	20				0			1		18	⁴ 1		0
1946	10				0			0		9	1		0
1947	22	2			0	1		6		12	1		0
1948	12	0			1	1	0	8		0	2		1
1949	24	3		2	6	0	4	8		0	1		1
1950	53	7	⁵ 5	10	6	1	3	11		0	10		2
1951	75	6	⁽⁵⁾	14	14	3	2	16	8	11	1		2
1952	70	7	⁶ 7	16	10	2	0	12	9	0	3	4	2
1953	52	8	³ 5	9	11	3	4	2	7	⁽⁵⁾	2	1	3

¹ The academic year is defined as the 12-month period prior to the close of the spring session, which is in June at most colleges and universities. No degrees were awarded in the years omitted from the table.

² Includes 4 non-United States nationals.

³ Includes 1 non-United States national.

⁴ Includes 1 woman.

⁵ Curriculum not offered this academic year.

⁶ Includes 2 non-United States nationals, 1 of whom is a woman.

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