MEAN AND MEDIAN AMOUNTS AND PERCENTAGES OF TOTAL EXPENDITURES ALLOTTED TO EACH ITEM OF THE BUDGET

	Number of families reporting expenditure	Amount of expenditure			
		Mean	Median	Mean	Median
Total expenditure	96	$5,511.77	$4,893.22	100.0	100.0
Food	96	$893.73	$807.50	17.3	16.8
Clothing	96	487.78	440.33	9.4	8.8
Shelter	96	871.11	684.50	17.1	15.8
House operation	96	746.49	568.21	13.1	12.2
Total miscellaneous	96	2,512.44	2,047.19	43.1	41.2
Investments	90†	774.34	357.50	12.7	7.9
Automobile	55	673.35	364.00	10.3	6.2
Recreation	96	286.50	197.85	5.1	4.1
Health	95	316.33	203.16	5.7	3.9
Dependents	34	250.39	200.00	5.1	3.1
Gifts	94*	123.41	100.00	2.3	2.0
Education	96	164.06	69.30	2.6	1.5
Professional expenses	93*	169.27	60.00	2.9	1.3
Incidentals	95	93.23	55.00	1.7	1.2
Associations	94	75.74	49.70	1.3	1.1
Church	52	64.01	30.00	1.3	0.6
Charity	90§	41.47	27.00	0.7	0.6
Tobacco	61*	34.21	25.00	0.6	0.4

* In 1 additional case, expenditure was reported but the exact amount was not available.
† In 2 additional cases, expenditure was reported but the exact amount was not available.
§ In 3 additional cases, expenditure was reported but the exact amount was not available.

to meet standards of living rest upon unsettled questions about the nature, the quantities and the costs of the several levels of living. Wise men, democrats and perhaps demagogues, unite in questioning the relation between income, a long scale of wants, and healthful and comfortable modes of existence. Much can be said for the Greek idea of the opportunities that lie in avoiding comfort. The country editor who, when he read my statement about $5,000 being not enough for comfort at a professional standard, waxed eloquently indignant about the lack of economic sense of those who spend $1,000 to $2,000 a year on automobiles, tobacco and recreation, has everything in favor of his position, except matter of fact. Inexorable custom jostles him and all professional men daily. Standard of living is not a question of prerogative but of practical utility. Like the rest of those who earn, the professor is in a specific occupational group. The idealists notwithstanding, occupational relationships react to settle effectively customary notions about modes of living. Given, the test of custom, the standard and cost of living displayed by the facts shown in this paper are minimum for professional men; these show the habitual mode of living that those who have spent long years in training for the profession consider "necessary and proper."

If the salaries of the full professor at least can not yield the average of $5,000 necessary to satisfy "custom" needs such as these budgets display, it is to be feared that men of initiative will leave the classrooms of universities to classroom plodders.

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THE INDUSTRIAL SIGNIFICANCE OF SOME RECENT DEVELOPMENTS IN ORGANIC CHEMISTRY[1]

WHEN I compare the little I have to say with the length of my title I feel like a microbe with a Latin name.

My appearance on the program anyhow is due far more to my desire to have an opportunity to congratulate the Division of Industrial and Engineering Chemistry on its fine record of accomplishment during

[1] A paper read on September 11, 1928, at the meeting of the American Chemical Society at Swampscott, Massachusetts.

the twenty years of its existence. It was authorized, as some of you remember, in 1908 and began to function in that year, its activities thus antedating those of any other division of the society. I recall with much pleasure that I had the privilege of serving as your first chairman.

The following year the *Journal of Industrial and Engineering Chemistry* began publication. We may fairly claim it as our official organ, though we will permit other divisions to share the pride we take in its splendid service to applied chemistry and its great value as a source of revenue to the society. It is the only self-sustaining publication of the society and, as an addition to our assets, is equivalent to an endowment of at least a million dollars, since it yields a net income of about $70,000 a year.

We may also fairly claim a continuity of identity in those other divisions, which, by a process of budding or cell division, have extended and segregated our activities into gas and fuel, petroleum, sugar, rubber, cellulose, leather, medical products, sanitation and other fields.

But I must not forget that I am expected to say something about the industrial significance of some recent developments in organic chemistry.

We are all familiar with the great and diversified industries which have the aromatic compounds as their basis. We are now entering an era of industrial development in which the aliphatic compounds, and especially those derivable from petroleum, seem likely to prove of equal or greater significance. In my own laboratory we have demonstrated that the vapor-phase cracking of petroleum for gasoline results in the incidental production of a large volume of gas composed chiefly of unsaturated compounds, of which the olefins constitute the greater part. From them it is now easy to proceed to the preparation of secondary and tertiary alcohols, chlorhydrins, glycols and solvent esters. It seems altogether probable that within a few years the production of these compounds, together with ethyl and isopropyl alcohols and their derivatives, will become an important adjunct of the petroleum industry and yield petroleum products of a new order of value. Through processes developed in our laboratory there was secured in small-scale commercial operation, at Tiverton, Rhode Island, per barrel of gas oil consumed, 19 gallons of motor fuel of 437° F. end-point, .85 gallons of tertiary butyl alcohol, 1.65 gallons of secondary alcohols, propylene convertible into 2.5 gallons of isopropyl alcohol, together with 800 cubic feet of residual gas, 25 per cent. of which was ethylene.

It is time for the sugar industry to look about for new uses for molasses. Some such new uses are in sight, as in the fermentation processes for the production of glycerine, but those which offer the greater promise of tonnage consumption are concerned with the preparation of protein foods from yeast. Whereas it requires about a hundred pounds of foodstuffs to produce five pounds of beef and three acres of land to support a cow, thousands of pounds of solid yeast protein can be developed and separated in a few hours in a very limited space from molasses and many other wastes containing fermentable sugars.

Ethylene, which constitutes the major proportion of the gas developed by vapor-phase cracking, has marked advantages over ether for anesthesia and is also the basis of a new technique for the ripening of fruits. One cubic foot of ethylene a day introduced into a room of 5,000 cubic feet capacity will bring oranges to that golden color which nature requires weeks to develop. Lemons picked grass green and carefully cured with ethylene compare favorably in every way with lemons ripened on the tree and will ship better.

Tomatoes, celery, bananas and other fruits lend themselves to similar treatment to advantage, and we may even look forward to a time when melons will look even more like melons and taste less like squash.

At the meeting of the Society of Chemical Industry, just closed in New York, Dr. F. E. Denny gave some remarkable demonstrations of the influence of various organic compounds, and conspicuously that of ethylene chlorhydrin, ethylene dichloride and sodium thiocyanate, in shortening the normal rest period of plant buds. Potatoes so treated sprout nearly two months earlier than they otherwise would, and in many localities it is thus made possible to grow two crops a year instead of one. Similar treatment of the buds of flowering plants enables the horticulturist to secure blooms at seasons otherwise impossible and when his product can command abnormal prices.

A field of much industrial significance has been opened up by processes developed along independent lines by Penniman, James and the du Pont laboratories for the oxidation of petroleum hydrocarbons. These have resulted in the production, by relatively simple means, of whole series of alcohols, aldehydes, ketones and fatty acids. The immediate problem appears to be that of separating the products from the complex mixtures in which they are first obtained.

From pentane, by the Sharples process, which involves its chlorination, the various amyl alcohols are now produced in quantity and their acetates are available as solvents for nitrocellulose.

The extraordinary development within the last five years of nitrocellulose lacquers and finishes has pro-

vided a powerful stimulus to research in the fields of paints, varnishes and solvents. The production in this country of these lacquers and finishes has grown from about 2,000,000 gallons in 1923 to approximately 25,000,000 gallons in 1927.

The low-temperature carbonization of coal is the subject of intensive study in many countries, including our own, and sufficient progress has already been made to demonstrate its commercial feasibility. It seems destined ultimately to have a profound effect upon the gas industry and to hasten the day when our cities will be measurably free from the smoke which now defiles them. The light tars which are produced in quantity in low-temperature carbonization are markedly different in character from ordinary coal tar and are a promising field for scientific investigation as a preliminary to the development of a new coal-tar industry.

Coal seems destined in fact to play a part of greatly increased importance as the raw-material basis of new chemical industries. In support of this opinion I need only mention the success of General Patart in France in effecting syntheses of alcohols and aldehydes from water-gas; that of Fischer in Germany for the production, also from water-gas, of the whole series of paraffin hydrocarbons from methane to solid paraffins; and finally, the remarkable results secured by Bergius in the liquefaction of coal. While it does not seem probable that we shall for many years to come turn to water-gas as the source of liquid and solid hydrocarbons or substitute for petroleum products the oils derived from coal, it may easily happen that we shall convert water-gas to methane and thereby permit the gas industry to distribute a non-asphyxiating gas of such enhanced heating power as to double the energy-carrying capacity of the distribution systems. It also seems probable that through the application of the Bergius method of hydrogenation the tars and bottoms of the petroleum industry may be converted into lighter and more valuable products.

The rubber industry, which has heretofore based its operations on the use of coagulated crude rubber, is now entering upon a new period of development, which, though originally based upon rubber latex, is being extended to include artificial dispersions made from crude rubber, vulcanized rubber or reclaimed rubber by milling and kneading the rubber with water and an inert material such as clay, and with the addition of small amounts of some protective colloid. Many important applications involving the use of rubber dispersions are already well under way.

Much interest has recently been aroused in the problems concerned with the possible utilization of the immense amounts of agricultural wastes annually produced in this country. As to their quantity you may take your choice between estimates ranging from 500,000,000 to a billion tons a year. It is enough in either case to concern those interested in the conservation of our resources. It goes without saying that there are in these wastes a quality and an amount of vegetable fiber adequate to supply a large proportion of our requirements for paper stock, and it is obvious to you that from this purified cellulose the whole range of products based on cellulose compounds can be made. Whether they can be made at a profit is quite another question. It can only be answered after yields of fiber, costs of collection and many other economic factors have been determined. There is now so much activity in this field that it seems probable that reliable answers to these questions may soon be forthcoming.

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SCIENTIFIC EVENTS

THE LIFE AND SERVICES OF JOHN WARREN. 1874–1928

THE following minute was placed on the records of the faculty of medicine of Harvard University at the meeting of November 1, 1928:

Five generations, in direct succession from father to son, of men eminent in the medical profession, men intimately connected with the Harvard Medical School or the Massachusetts General Hospital—this is a record for which Boston may well feel a proper pride and deep gratitude. In the death of the last of this direct medical line the Harvard Medical School suffers a profound loss.

John Warren, associate professor of anatomy, died suddenly on July 17, last. His connection with the anatomical department had lasted twenty-eight years, for he was appointed assistant in anatomy in 1900, the year after his graduation. From the very beginning of his career his chief interest lay in teaching. His position brought him under the influence of his kinsman, Dr. Thomas Dwight, then Parkman professor of anatomy, a forceful and very lovable example of the older type of professor, by whom the didactic lecture was considered paramount for instruction. It may be that intimate association with Dr. Dwight or perhaps a native gift handed down from his great-great-grandfather, the first professor of anatomy at Harvard, accounts for John Warren's proficiency in the art of the careful preparation and clear and forceful delivery of anatomical lectures, of which he soon became a master. With this he also attained a depth of knowledge of human anatomy and a skill in displaying it by dissection which were acknowledged by all his colleagues in later years and appreciated by a long succession of medical students.

Living as he did in a surgical atmosphere, trained to believe that a sound and detailed knowledge of human