have much to be ashamed of in our record of disastrous land misuse. When we are told that Italy is spending $500,000,000 on her "Boniface Integrale" program of land conservation and reclamation, it would seem that those of us who have a real interest in the continuing welfare of the United States should be moved to action whenever those who know something of the subject assert that the nation can not afford not to spend now and in the near future whatever is necessary to conserve our remaining areas of good agricultural land. When we find that in parts of Germany much the same method of correct land use as that employed in the program of the Soil Erosion Service has been used for many years, and with a high degree of effectiveness and local satisfaction, in connection with their land programs, it would appear that there should be no undue concern on the part of any patriotic citizen if this program is markedly different from anything which has ever been tried in any important way in the United States. When we find Japan, in her program of protecting valuable agricultural lands, spending many times the value of those areas occupying erosive slopes for the purpose of protecting valuable tracts of lower land from the ravages of erosion and runoff descending from above, why should we be unduly concerned if in some localities it may be found necessary to spend in some instances as much as the land is worth in order to protect it, and thereby lower-lying areas affected by it—and at the same time give protection to stream channels and reservoirs from the erosional products discharged from such critical areas?

Flood Control and Silt Prevention

When it is considered that quantitative measurements of erosion and runoff from 12 extensive and highly important types of agricultural soil scattered throughout the country show that grass and similar thick-growing crops average 65 times more effective with respect to soil conservation and cause five times as much of the rainfall to sink in the ground at or near where it falls than on the same types of soil occupying the same degree of slope and receiving the same amount of rainfall, but devoted to clean-tilled crops, no further argument should be necessary to convince any thinking person that by bringing these densely planted crops more generally into use on the more erosive areas it will be possible to bring about some close approximation of permanent flood control and a large reduction in the hazard of silting of stream channels and costly reservoirs. Conversely, it should be clear enough to any one that until this is done—until we strike at the critical points of accelerated runoff from cultivated and overgrazed slopes, from the very crests of ridges down across watersheds where floods really originate and silt loads are picked up—we shall never have any very close approximation of permanent flood control or any important reduction of the hazard of silting, within many drainage basins, at any rate. On the basis of accumulated information, it appears entirely practicable to bring about that degree of erosion control and prevention—which really means control of the runoff—over most of the crop lands of the nation and over much of the grazing lands. It appears quite possible that this work, which must be done some time regardless of the inclination of any one, would result generally in something like a 25 per cent. reduction in the volume of floods, with perhaps greater reduction in some drainage basins. If this appraisal of the possibilities of erosion control is correct, then we can in a practical way bring about adequate flood control and a tremendous reduction in the costly filling of stream channels and reservoirs.

The Path Ahead

The course that the nation must pursue if this is to be a permanently productive agricultural country seems clearly marked out. If we refuse to conserve our agricultural lands, obstinately continuing with old methods that have failed, then we may as well confess that we have consciously chosen to head straight in the direction of land disaster. Since posterity can not meet the task and since many farmers are unable to handle all phases of the work that must be done, the responsibility of the government is obvious. Aside from this responsibility, the government has a very definite and inseparable interest in the continuing welfare of its remaining areas of good agricultural land.

PRESENTATION OF PROFESSOR JULIUS ARTHUR NIEUWLAND, C.S.C., FOR THE AWARD OF THE AMERICAN INSTITUTE MEDAL[1]

By Professor MARSTON TAYLOR BOGERT
COLUMBIA UNIVERSITY

"Well, Father, now that you have taken so much trouble to show me all through your laboratories and explain so fully the conditions under which your research work is carried on, I am more than ever impressed by your splendid record of achievement!"

"Oh!" he said, in his characteristically modest way, "you overestimate what little I have been able to

[1] Hotel Astor, New York, February 7, 1935.

accomplish. It is true that we have been handicapped somewhat in our investigations by lack of needed equipment, and particularly of an adequate chemical library, but the university has done everything in its power to help me and I have been very happy in my work."

We had spent most of the day together in visiting various departments of the University of Notre Dame, giving me an opportunity of renewing old friendships, and were seated in his little private office which, like its presiding genius, was simple and unpretentious.

Born of Flemish parents in Hansbeke, Belgium, on February 14, 1878, only about nine miles along the Bruges road from Ghent, in which latter city 15 years earlier another famous Belgian chemist, Leo Hendrik Baekeland, first saw the light of day, his family emigrated to this country when he was but two years old and settled in Mishawaka, near South Bend, Indiana, where a number of his fellow Belgians were already in residence. It was natural, therefore, that in selecting his college he should have chosen the adjoining University of Notre Dame, where he received the A.B. degree in 1899 and the honorary degree of Sc.D. in 1911. In 1904, the Catholic University of America conferred a Ph.D. degree upon him.

Ordained a priest of the Roman Catholic Church in 1903, he joined the Congregation of the Holy Cross (C.S.C.), and in 1904 was appointed professor of botany at his alma mater.

This chair he filled with distinction for 14 years, acting also as curator of the botanical herbarium and of the E. L. Greene Herbarium as well as botanical librarian. During this period, he founded *The Midland Naturalist,* the first number of which appeared in April, 1909, and which later changed its name to *The American Midland Naturalist.* For 25 years he served as its editor, and contributed numerous articles to its pages, as well as to other journals. In fact, he tells me that he has already published more articles of research in botany than he will have done in chemistry if he lives a dozen years more, for he is still contributing papers in the botanical field.

One reason why his professional career began with botany, rather than with chemistry, was that when he entered the University of Notre Dame they had practically no chemical library and no funds available for the purchase of chemical journals or reference works. Books on systematic botany, however, were much less expensive and journal files not so essential. By supplying various educational institutions with microscope slides, and in other ways, he earned a little extra money which was promptly invested in botanical books, and in this way he gradually accumulated some 2,500 volumes, as well as over 20,000 plant specimens. Upon the death of his former professor of botany, the library and herbarium of the latter became the property of the university, and this added some 4,000 books and over 100,000 plant specimens to what he had already gathered, so that to-day Notre Dame still has a better botanical library than a chemical one, and botany still remains his hobby and his relaxation, for he has collected plants in nearly every state in the union. As he said to me only a short time ago: "When out in the wilds, my mind is distracted and becomes acquainted again with old plant friends. Seldom do I go into the field without finding something not only new to me but new to botanical science."

In 1918, his title was changed to professor of organic chemistry, and he has occupied that chair at Notre Dame ever since. For three years (1920–3) he was also dean of the College of Science. His chief contributions to the progress of organic chemistry have been in the field of acetylene and its derivatives, although he has published important articles in other fields as well (organic reactions with boron fluoride, lewisite, dyestuffs, hexamethylene tetramine, acetals, vulcanization accelerators, alcohols, ethers, etc.).

His first paper on acetylene appeared in 1904, in the *Journal f. Gasbeleuchtung* (Vol. 48, pp. 387–8), and was entitled "Some Reactions of Acetylene." It dealt with the electrolytic reduction of acetylene and with its chlorination. It was followed two years later by "Reactions of Acetylene with Acidified Solutions of Mercury and Silver Salts" (with J. A. Maguire) which, like practically all his subsequent chemical papers, was published in the *Journal of the American Chemical Society* (Vol. 28, pp. 1025–31, 1906).

Further studies in the chemical field were then interrupted for more than a decade by his duties and activities as professor of botany and, although he was granted a U. S. Patent (No. 1, 326, 367), under date of December 30, 1919, for a "Dye bath formed with *p*-phenylenediamine and mercury compounds," it was not until 1921 that publication in the acetylene group was resumed with his report (with R. R. Vogt) on the "Rôle of Mercury Salts in the Catalytic Transformation of Acetylene into Acetaldehyde, and a New Commercial Process for the Manufacture of Paraldehyde,"[2] followed by papers on "Acetylene Compounds with Silver Phosphate and Silver Arsenate" (with P. B. Oberdoerfer),[3] "The Preparation of Oxalic Acid from Acetylene" (with Miss Kearns and L. Heiser),[4] "The Catalytic Condensation of

[2] *Jour. Am. Chem. Soc.*, 43: 2071–81, 1921.
[3] *Jour. Am. Chem. Soc.*, 44: 837–40, 1922.
[4] *Jour. Am. Chem. Soc.*, 45: 795–9, 1923.

Acetylene with Benzene and Its Homologs" (with J. S. Reichert),[5] "The Catalytic Condensation of Acetylene with Phenols" (with H. H. Wenzke)[6] and the taking out of a Canadian patent (No. 250,295), June 2, 1925, with H. W. Matheson, for a "Synthetic resin," manufactured by passing acetylene into a phenolic substance containing sulfuric acid and a mercury salt, at a temperature of 50–150°.

In December, 1925, the American Chemical Society held, at Rochester, N. Y., its first organic chemistry symposium. One of the addresses presented on that occasion was a review by Dr. Nieuwland of his researches on acetylene and its derivatives, in the course of which he discussed, among other reactions, the formation of divinylacetylene by passing acetylene over cuprous ammonium chloride. I well recall the address and the favorable impression it made.

It happened that there was also present at the time Dr. Elmer K. Bolton, then in charge of the chemical research work of the Dyestuffs Section of E. I. du Pont de Nemours and Company, Inc., of Wilmington, Del., and now chemical director of that corporation. One of the principal initial materials for the manufacture of synthetic rubber then was a hydrocarbon known as butadiene, which was not a natural product but had to be obtained by various synthetic methods, and the corporations interested, abroad as well as here, were eagerly seeking new methods of manufacturing this raw material more cheaply. Shortly before (in 1925) this Rochester meeting, Dr. Bolton had suggested to his superiors the possibility of obtaining this butadiene from acetylene, by oxidizing the latter to diacetylene and then reducing the diacetylene, but after listening to Father Nieuwland's paper, it occurred to him that if it were practicable to make monovinylacetylene commercially from acetylene, it might offer a still more satisfactory route to butadiene and synthetic rubber. Upon discussing the problem with Dr. Nieuwland, the latter was of the opinion that it might be feasible, for he had already some evidence that the monovinyl was formed along with the divinyl derivative in the reactions he had described.

Accordingly, a group of du Pont chemists, under the able leadership of Dr. Wallace H. Carothers, began that active cooperative investigation with Dr. Nieuwland which has achieved such a brilliant success in the discovery of the new synthetic rubber substitute now marketed under the name of "Duprene."

In the course of this research, it was found that, in the presence of a suitable catalyst, hydrogen chloride could be added easily to the monovinylacetylene, with the production of a chlorobutadiene which, on standing, changed (polymerized) to an elastic mass closely resembling natural rubber, and in this way Duprene was born. Father Nieuwland's major contributions to this birth of a new industry have been the methods for the preparation of the mono- and di-vinylacetylenes, and assistance in the determination of the proper catalyst for the addition of the hydrogen chloride. Considerable embarrassment has been occasioned him by well-meaning but misinformed writers who have constantly referred to him as the inventor of Duprene. These misstatements he has done his best to correct, but they still persist and crop up every now and again in the press. It is no minifying of Father Nieuwland's work to point out that the discovery of Duprene was not made by him, but by the du Pont Company. Without his brilliant contributions to the chemistry of acetylene, however, this splendid accomplishment of the great du Pont organization could not have been realized. It was Nieuwland's pioneer work which opened the road to Duprene.

Although chemically not at all identical with natural rubber (for Duprene contains some 40 per cent. of chlorine), it bears a closer physical resemblance to it than any of the synthetic rubbers previously known. Those respects in which it differs from the natural product make it superior for some purposes and inferior for others. Its physical properties are susceptible of wide variation, depending on the character and amount of vulcanizing agent, reenforcing pigment, etc., compounded with it. It is particularly valuable in filling the need for a rubber-like material with greater resistance than natural rubber to the solvent action of gasolene, oils and other liquids, as well as to the deteriorating and disintegrating effects of heat and oxidation.

Although Duprene can not yet be manufactured at the current price of natural rubber, its selling price nevertheless imposes a limit upon that of the latter.

A little over a month ago (December 17, 1934), in the hearings at Washington before the Reciprocal Trade Agreement Committee, the Hon. Francis P. Garvan, former Alien Property Custodian and now president of the Chemical Foundation, Inc., presented a notable address, in the course of which this great benefactor of American chemistry and eloquent champion of our chemical industries had the following to say on the subject of rubber:

> We consume 65 per cent. of the world's production of rubber. In 1926, we imported 925,878,000 lbs. at an average price of 54.6¢, for which we paid $505,818,000. This year, we are roughly importing the same amount for which we will probably pay an average of 14¢ at a cost to us therefor of $130,000,000.
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> In 1926, under the Stevenson plan (in reality an English-Dutch cartel) the price was driven as high as $1.25 a pound. In 1934 the Stevenson plan has been

5 *Jour. Am. Chem. Soc.*, 45: 3090–1, 1923.
6 *Jour. Am. Chem. Soc.*, 46: 177–81, 1924.

revived, but under a tighter cartel, and the only reason, as announced in the English press, that the price is not driven up to our people, as it was in 1926, is the fear of encouraging the development of Duprene. In other words, this discovery even now is possibly saving us at the rate of $375,000,000 a year.

Father Nieuwland's researches and their bearing upon the discovery of Duprene have had a peculiar fascination for me. For over 40 years, as a student of organic chemistry, I have followed the numerous attempts made in various countries to synthesize rubber on a commercial scale.

It was my good fortune to preside over the meetings of the Organic Section of the Eighth International Congress of Applied Chemistry, held in 1912 in New York and Washington, and at those meetings the rival claims of Great Britain and Germany, in the synthetic rubber field, were vigorously presented by Dr. Duisberg of Germany and the late Professor William H. Perkin of England.

Not long after these meetings, an elderly German chemist, Dr. Louis Gottschalk, applied to me for the use of space in our organic laboratories at Columbia University, to carry out experiments in this same field. He explained that he had discovered a wonderful new process and all that he needed to perfect it was laboratory space and equipment. His process, however, involved the use of steel bombs, the contents of which were heated to enormous pressures. It was explained to him that we could not undertake anything so hazardous, for if one of those bombs exploded the effect would be as devastating as the explosion of a 12-inch shell. So he organized the Alembic Process Company, with his wife, his son-in-law (George Titus) and a chemical engineer (Clifford D. Meeker) as his associates, and established a laboratory at Sewaren, N. J. On September 14th, 1913, one of these bombs let go and killed his wife instantly. Six months later, a second bomb exploded, blew Mr. Meeker and the laboratory to bits and seriously injured Mr. Titus. That was the last I ever heard of Dr. Gottschalk or his "alembic process."

The layman is familiar with the facts that acetylene is the gas commonly used for household lighting in those isolated or back-country districts where neither electricity nor the ordinary illuminating gas are available; that it was employed also in the old-fashioned automobile headlights; and that its chief service today is in oxy-acetylene torches for cutting and welding. He may know also that this gas is generated by the action of water upon calcium carbide and that the carbide is manufactured by heating in an electric furnace a mixture of lime and carbon; but that is usually as far as his information extends.

To the chemist, however, acetylene is of transcendent interest, because it is in many respects the most fundamental and most valuable building unit for the whole vast structure of synthetic organic chemistry, for Berthelot showed, more than 70 years ago (January, 1863), that acetylene could be prepared by passing an electric arc between carbon poles in an atmosphere of hydrogen; in other words, that acetylene could be produced from the elements carbon and hydrogen themselves; and this gas is a highly unsaturated compound, which unites so avidly with certain elements that violent explosions ensue. In the presence of suitable catalysts, and when no other substance is at hand, it will unite with itself, that is to say its constituent molecules combine to larger aggregates, "polymerize," as the chemist calls it, and in this way mono- and divinyl-acetylenes are formed.

It is no exaggeration to say that hundreds of thousands of carbon compounds can be built up step by step from acetylene, for it is not only the foundation of what is known as aliphatic chemistry but of aromatic chemistry as well, both isocyclic and heterocyclic. Products of vital functions, indispensable drugs, dyestuffs, perfumes, plastics and an innumerable host of other useful compounds can be obtained from this remarkable hydrocarbon.

Is it any wonder, then, that Father Nieuwland should have elected to study more closely its chemistry, even though he realized that such experiments were fraught with some peril to the experimenter? In the course of his work he has, of course, had some explosions, but fortunately without any tragic results, and he has finally tamed these dangerous forces so that now, when he addresses them sternly, they reply obediently, "Yes, Father!"

Unlike certain governmental officials who are so successful in making two lemons grow where only one grew before and then handing them both to you when you are not looking, Father Nieuwland has really made new compounds grow and blossom where none were known before and by his discoveries has contributed to the founding of a new and most promising industry.

Many of the facts he utilized in this achievement had lain buried in the literature for decades, waiting patiently for the arrival of that master who should fit them into their proper places in some worthwhile plan for the progress of science and industry.

Professor Nieuwland is a member of many scientific societies both here and abroad, and has been the recipient of numerous honors.

He was president of the Indiana Academy of Science during its Jubilee year (1934). In 1933, he received the John Motley Morehead Medal of the

National Acetylene Association and has just recently been awarded the William H. Nichols Medal of the American Chemical Society, "for basic work on syntheses from unsaturated hydrocarbons." The ceremony at which this latter medal will be presented to Father Nieuwland is planned to be one of the outstanding features of the celebration of the tercentenary of the founding of the American chemical industries, to be held in this city during the week of April 22, in connection with the eighty-ninth meeting of the American Chemical Society.

Modest, unassuming, a most delightful companion and lovable personality, to know him is to become immediately his warm friend and admirer.

Mr. President, I now have the honor to present Julius Arthur Nieuwland, eminent chemist and botanist, for the award of the Gold Medal of the American Institute. In the citation of our Council on Awards, this distinction is recommended "for a life-time of patient research devoted to new fields of organic synthesis based on acetylene, to which he has made notable contributions."

OBITUARY

HERDMAN FITZGERALD CLELAND

Herdman Fitzgerald Cleland, Edward Brust professor of geology and mineralogy at Williams College, was born at Milan, Illinois, July 13, 1869, the son of David J. and Margaret (Betty) Cleland. He met a tragic death in the *Mohawk* disaster on January 24, 1935, while en route to Yucatan with a party of young men whom he was to guide in the study of the Mayan remains. Three of the students, all seniors at Williams, shared his fate.

Cleland was of Scotch and Irish ancestry. His grandfather, Samuel Cleland, was a graduate of the University of Glasgow and of the Theological School at Belfast College. He came to the United States in 1826, and was pastor of various Presbyterian churches in Ohio, Iowa and Illinois till his death in 1865. Cleland's maternal grandfather, John Betty, came to this country from Ireland in 1842 and was engaged in various commercial enterprises. Herdman inherited a tradition of culture, refinement and scholarship. His thrifty Scotch training was a lifelong advantage. He lived simply but well, always managing to set aside something to be used in helping others. President Tyler Dennett has said of him: "He was also generous, one of the most generous citizens of Williamstown, not in ostentatious ways, but quietly and simply as he lived. I am told that there is more than one family in our village, which, due to his help, now owns the roof over their heads. There are others, many of them, who learned that when in sore need they could find both sympathy and substantial help. A model teacher, he was in equal degree a model citizen."

His last reported words, "I'm sorry the trip is off, boys, but I wish they had waited till the water was warm before they threw us in," show that he faced the end with the same calm courage and dry humor that had carried him through other crises in his life. Although quiet and reserved, he had an infinite capacity for making friends, to whom his conversation was a delight. He was fastidious, physically and mentally, and was annoyed by much which he saw and read; but his criticisms generally emerged as witty remarks which did not sting; yet were so pointed that they often produced good results. He was forthright and frank, yet withal so just that he aroused no personal antagonism. The mass production of the lecture system did not appeal to him. He was profoundly interested in each of his students, ever ready with counsel, advice and stimulation. That his students were well trained is attested by the records of the geologists who have graduated from Williams during the last thirty-three years. His instruction and his personality equally influenced a majority of his students who did not become professional geologists.

Cleland's early education was greatly delayed by the inadequacy of the schools in the small frontier town in which he passed his earlier years. He received a part of his preparatory training, and took two years of undergraduate work, at Gates College in Nebraska, but received his A.B. at Oberlin in 1894, where his interest in geology was fostered by the late Professor Alfred A. Wright. After graduation, ill health forced him to return for a year to the home of his father at Pierce, Nebraska. He attended the summer session of the University of Nebraska in 1895, and that fall entered upon the duties of professor of natural sciences at Gates College, where he remained three years. A summer at the University of Chicago in 1896 crystallized his leanings toward geology, and, realizing the difficulty of teaching all the natural sciences, he gave up his position at Gates College in 1898. That autumn he entered the graduate school at Yale, studying chiefly under Henry Shaler Williams, then the outstanding exponent of stratigraphic paleontology. He received his degree of doctor of philosophy there in June, 1900.

Being at a loose end, he that summer joined the first of the notable peripatetic summer schools con-