tinued to rise, indicating the liberation of further hydrogen by the direct action of alpha particles on the droplets of liquid. No sign of solid hydrocarbons appeared.

According to ionization the reaction mechanism may be interpreted as follows. The primary reaction is the removal by alpha particles of electrons from molecules of ethane:

$$C_2H_6 = C_2H_6^+ + 1e$$

The resulting active ethane ion forms complexes by addition of ordinary neutral ethane molecules:

$$C_2H_6^+ + C_2H_6 = (C_2H_6)_2^+$$

or

$$C_2H_6^+ + 3C_2H_6 = (C_2H_6)_4^+$$

Upon electrical neutralization by free electrons (from the original ionization) hydrogen would be split out, giving butane or octane as the case may be.

The reaction appears to possess interest from several angles: (1) It appears to confirm the hypothesis of complex formation by ions proposed by one of us at the Dayton meeting of the American Electrochemical Society (Trans. *44,* 63–71 (1923)). (2) It is the first instance of a method of directly synthesizing higher from lower hydrocarbons, by α radiation. (3) It will be of interest to see whether contact catalysis will be found to produce the same reaction in larger quantity. (4) The possibility is suggested that the same complex may break down in two or more ways, giving different products. It will be important to determine how these ways may be influenced or controlled, as having a possible bearing on the cracking of hydrocarbons. (5) Since α-radiation is present everywhere in the earth's crust, it is evident that a process is at hand in nature by which lower hydrocarbons could be stepped up to higher ones, as well as broken down. However, the complete absence of free hydrogen in natural gases and petroleum remains to be explained.

A more detailed study of this and similar reactions is under way, in which it will be undertaken to determine what fraction of the primary reaction results in higher hydrocarbons and what in complete decomposition to hydrogen and carbon.[2]

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[2] The possibility of synthesizing higher from lower hydrocarbons by silent electrical discharge was long ago discovered by Berthelot (Comp. rend. *126,* 568 (1898)). Professor Boltwood (private communication) informs us that in work on the production of helium from radium he and Professor Rutherford had occasion to confine radon by a solid plug of paraffin. After several days large quantities of hydrogen were found to have been given off and the paraffin plug could no longer be melted, even by heating almost to the softening point of the glass.

## NICOTIANA RUSTICA AS A SOURCE OF NICOTINE FOR INSECT CONTROL[1]

THE value of nicotine preparations for the control of aphids, leaf hoppers, red spiders and many other insects has long been recognized. The general interest in these preparations, however, has been greatly stimulated in recent years, owing to the experimental work of Smith[2] and many others on the use of natural and artificial nicotine dusts, with the result that more nicotine is used as an insecticide at the present time than ever before.

Nicotine for insecticidal purposes is derived almost entirely from stems, stalks and waste leaves of commercial types of tobacco of low nicotine content. This source of supply is dependent on the amount of tobacco wastes used for other purposes. Under the existing conditions, therefore, the cost of nicotine preparations, must, of necessity, be relatively high.

Realizing the importance of augmenting the natural supply of nicotine, the U. S. Bureau of Plant Industry, in cooperation with the Pennsylvania State College, started experimental work in 1914 on the practicability of cultivating tobaccos for their nicotine content alone. Various types of "high nicotine" tobaccos were used but were soon discarded, with the single exception of *Nicotiana rustica,* a leathery tobacco unsuited for the usual purposes of manufacturing and possessing an extremely high nicotine content. The nicotine content of these plants has since been increased by processes of selection.

In the fall of 1923, a number of carefully selected fairly mature plants of this type were sent to the Pennsylvania State College by Mr. Otto Olsen (expert in charge of tobacco investigations at Ephrata, Pennsylvania), with the request that studies be made on the whole plants relative to their nicotine content and utilization for insecticidal purposes. These plants came from Lancaster and Clinton Counties, Pennsylvania, and had received the same fertilizer treatment. Some of the plants had been topped, while others were kept free of suckers during their growing season. Several were both topped and suckered and the remaining plants were untreated. The whole plants, minus their root systems, were dried, weighed and analyzed for nicotine according to the method of Shedd.[3] The results obtained are given in the following table and are calculated on a water-free basis:

[1] Published as Paper No. 12, Department of Agricultural and Biological Chemistry, the Pennsylvania State College.

[2] Smith, R. E., "The preparation of nicotine dust as an insecticide." Univ. Cal. Pub., Bull. No. 336. 1921. pp. 261–274.

[3] Shedd, O. M., "An improved method for the determination of nicotine in tobacco and tobacco extracts." *Jour. Agr. Res.,* Vol. 24, No. 11. 1923. p. 963.

| Number of plants | Nature of treatment | Grams of dry matter per plant | Nicotine | |
|---|---|---|---|---|
| | | | Percentage | Grams per plant |
| 3..... | Topped | 170 | 2.75 | 4.68 |
| 5..... | Suckered | 144 | 3.79 | 5.46 |
| 11..... | Topped and Suckered | 124 | 4.40 | 5.46 |
| 5..... | Untreated | 144 | 1.61 | 2.32 |

Close similarities were observed between the nicotine content of the leaves and stalks of the topped and suckered plants from the two localities as evidenced by the analysis of composite samples as given below:

| Location | Percentage of Nicotine | |
|---|---|---|
| | In stalks | In leaves |
| Lancaster County | 2.05 | 7.30 |
| Clinton County | 2.22 | 7.05 |

The weight of tobacco produced from an acre of Nicotiana Rustica grown in Clinton County in 1923 amounted to 4,500 pounds, slightly more than our results indicate, assuming 11,000 plants per acre. Owing to individual characteristics of plants one would not expect the weights of different plants to closely parallel one another. In every case, however, when the plant had been either topped or suckered the percentage of nicotine was very much higher than that of an untreated plant. These results are in more or less agreement with those obtained by Oosthuizen.[4]

According to Shedd and Olney[5] nicotine can be readily extracted from tobacco wastes by steeping the material in cold water. Experiments conducted by us have substantiated their claim. We have found, however, that nicotine can be obtained more readily by treating the tobacco with cold water and bringing to a boil and filtering through cheesecloth immediately. A very few washings with hot water freed the residue of nicotine, while continued boiling of the sample was not so satisfactory. After the nicotine was extracted solutions were made up in concentrations varying from 0.06 to 0.2 per cent. nicotine. When mixed with a little soap these solutions were found to possess pronounced aphiscidal properties, comparable to the results obtained from the same concentrations of nicotine solutions made by diluting a standard 40 per cent. nicotine solution.

[4] Oosthuizen, J. du P., "Tobacco cultivation for nicotine," Union of S. A., *Jour. Dep't. Agr.*, Vol. 6, No. 2, 1923, p. 173.

[5] Shedd, O. M. and Olney, A. J., "The preparation from tobacco of a solution for spraying," Paper presented before the 67th meeting of the American Chemical Society, 1924.

Further studies relative to the utilization of *Nicotiana rustica* are being conducted by us at the present time.

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## THE WESTERN PSYCHOLOGICAL ASSOCIATION

THE fourth annual meeting of the Western Psychological Association was held at Stanford University on August 8 and 9.

The officers for 1923–24 are as follows: Edmund S. Conklin, *president,* University of Oregon; Arthur H. Sutherland, *vice-president,* Los Angeles Schools; Walter R. Miles, *secretary-treasurer,* Stanford University; Calvin P. Stone, *local committeeman,* Stanford University.

The program was as follows:

*Heredity, environment and mental achievement:* TRUMAN L. KELLEY.

*The geography of intelligence:* RAYMOND FRANZEN.

*Character and personality traits of gifted children:* LEWIS M. TERMAN.

*Intellectual factor in children's drawings:* FLORENCE L. GOODENOUGH.

*The validity of self-estimate:* EUGENE SHEN.

*The determiners of animal learning:* EDWARD C. TOLMAN.

*The problem of psychological set:* PAUL THOMAS YOUNG.

*Psychological systems in their relationship to selling:* EDWARD K. STRONG, JR.

*Description of eidetic phenomena:* HEINRICH KLUVER.

*A rotation table for laboratory animals:* FRANKLIN S. FEARING.

*Review of alcohol studies:* WALTER R. MILES.

*The classification of personalities:* EDMUND S. CONKLIN.

*Nervous and mental characteristics of Mongolian imbecility:* KATE BROUSSEAU.

*Freudian theory and sexual enlightenment: a study in resistances:* CAVENDISH MOXON.

*Intelligence tests of Los Angeles police force:* ELLEN SULLIVAN AND GRACE FERNALD.

*Some results on the development of mental control:* A. H. SUTHERLAND.

*Congenital behavior following cerebral lesions in rabbits:* CALVIN P. STONE.

*Psychological research in state institutions:* FRED NELLES.

*Educational achievement of children with personality and behavior difficulties:* PHYLLIS BLANCHARD, RALPH P. TRUITT AND RICHARD H. PAYNTER, JR.

*The analytical vs. the general diagnosis in clinical psychology:* LIGHTNER WITMER.

*The new type of functionalism:* WALTER B. PILLSBURY.