results of the study. The fuel factor also explains why sulfur pollution in most districts was approximately 50 per cent. higher in the "heating season" than in the summer months. Some industrial operations also discharge sulfur fumes, unless properly safeguarded.

A close relationship was found between wind velocity and the amount of sulfur dioxide in the air. The higher the wind the cleaner the air. Fogs catch and "store up" the sulfur fumes. Some of the highest concentrations were noted on foggy nights.

Occasional tests were made in a score of other cities. Dr. H. B. Meller, managing director of Air Hygiene Foundation, cautioned that results obtained in these cities can not be compared with the findings for St. Louis, Pittsburgh, Detroit, Philadelphia-Camden and Washington. He pointed out that "only a few tests were made in this group, not enough to arrive at a typical, average figure, as in the case of the five centers which formed the backbone of the survey." Results for the 20 other cities are given in Table 2.

TABLE 2

| City | Summer average | Winter average |
|---|---|---|
| Baltimore | .021 | .081 |
| Chicago | .067 | .091 |
| Cleveland | .064 | .081 |
| Wheeling | .070 | ... |
| Nashville | .028 | .093 |
| Cincinnati | .021 | .064 |
| Buffalo | ... | .044 |
| Youngstown | .049 | .026 |
| Louisville | .022 | .041 |
| Ft. Wayne | .028 | ... |
| Richmond | .009 | .047 |
| Indianapolis | .023 | ... |
| Toledo | .023 | ... |
| Chattanooga | .011 | .035 |
| Springfield, Ill. | .021 | ... |
| Birmingham | .017 | .017 |
| Charlotte, N. C. | .015 | ... |
| Johnstown | .014 | ... |
| Harrisburg | .011 | ... |
| Atlanta | .012 | .032 |

J. D. Alley directed the field work and compilation of data. Dr. J. L. Sherrick was in charge of the chemical laboratory. Both were fellows on the Air Hygiene Foundation Fellowship at Mellon Institute. Six chemists were employed in the field. One operated a "rover" laboratory, visiting a score of cities. The others were stationed in the five metropolitan districts described.

Each of the five field men traveled a prearranged route, covering about 130 designated stations in each of the five districts. The stations were scattered through business districts, parks, industrial sections and residential neighborhoods, and ranged from the center of a city to 25 or 30 miles in the suburbs. This was done to determine the *average concentration* rather than temporary "peaks" and "lows."

The field chemists worked a "staggered" schedule, 8 A.M. to 4 P.M., one week, 4 P.M. to midnight the next, etc. Their day off was also rotated. Thus over a period of 15 months they obtained comprehensive checks on sulfur concentrations for each hour of the 24, each day of the week and each season of the year.

JOHN F. MCMAHON

## THE NATURE OF THE CARBOHYDRATE IN THE GONADOTROPIC SUBSTANCE OF PREGNANCY URINE

THE presence of carbohydrate in gonadotropic hormone preparations from pregnancy urine has been observed by numerous investigators. Fischer and Ertel[1] have stated that the properties of their relatively crude material agreed closely with urinary mucoid and ovomucoid, while Meyer,[2] working with highly active preparations, also characterized the hormone as a mucoid. Hartmann and Benz[3] have very recently reported studies of the carbohydrate of their APL hormone preparations, but were unable to decide whether their material contained mannose, galactose or a mixture of both. They published no details regarding the purity of their product.

By a process which will shortly be published in detail, hormone preparations have been made assaying 1,000 to 3,000 units per milligram by the Friedman rabbit assay method. These fractions contain carbohydrate, hexosamine and acetyl groups[4] as previously found by Meyer[2] in his preparations. Pentose, ketohexose and uronic acid were shown to be absent.

Our early determinations[4] of reducing sugar by the Hagedorn-Jensen procedure gave values that were too high as a result of errors produced by the accompanying products of protein hydrolysis. Clarification with $Zn(OH)_2$ did not materially lower the figures. Similar errors have been observed by Mundy and Seibert[5] as well as Hewitt.[6] The Shaffer-Hartmann method, however, yields lower results.

Using suitable methods we have obtained evidence to indicate that our purest preparations contain 2 hexose groups for each hexosamine. Assuming that the carbohydrate in the hormone is composed of trisaccharide units containing 1 hexosamine and 2 aldohexose groups, we have compared two of our best preparations with the commonly occurring aldohexoses by means of the carbazole[7] and orcinol reactions.[8]

[1] F. G. Fischer and L. Ertel, *Zeit. physiol. Chem.*, 202: 83, 1931.

[2] K. Meyer in R. Kurzrock, "Endocrines in Obstetrics and Gynecology," p. 116. Williams and Wilkins, 1937.

[3] M. Hartmann and F. Benz, *Nature*, 142: 115, 1938.

[4] S. Gurin, C. Bachman and D. Wright Wilson, *Jour. Biol. Chem.*, 123: proc. xlix, 1938.

[5] B. Munday and F. B. Seibert, *Jour. Biol. Chem.*, 100: 277, 1933.

[6] L. F. Hewitt, *Biochem. Jour.*, 32: 1554, 1938.

[7] Z. Dische, *Mikrochemie*, 8: 4, 1930.

[8] J. Tillmans and K. Philippi, *Biochem. Zeit.*, 215: 36, 1929.

The color produced by the hormone preparation in the carbazole reaction was compared with those yielded by glucose, mannose, galactose and equimolar mixtures of all the pairs of these sugars. Determinations of the relative transmission of light in the spectral regions 420, 520, 540 and 660 mμ were made by means of an Evelyn photoelectric photometer. The characteristic ratios of extinction coefficients at two wave-lengths (*e.g.*, 420 and 520 mμ) for glucose, mannose, glucose-galactose and galactose-mannose were found to be different from that given by our hormone preparations, while galactose and a glucose-mannose mixture could not be distinguished from the hormone by this method.

To differentiate between our hormone preparation and galactose or a glucose-mannose mixture the orcinol method as modified by Sörensen and Haugaard[9] was utilized. Solutions of the hormone preparation, galactose and the glucose-mannose mixture (each in 3 different dilutions) were heated 20 minutes at 80–81° with the orcinol reagent and the colors compared at 420 and 520 mμ. The ratios of the extinction coefficients for our preparations and the glucose-mannose mixture were different, while those for the hormone preparation and galactose were similar.

As both the orcinol and carbazole methods gave ratios of extinction coefficients for our hormone preparations which agreed well with those obtained for galactose, we conclude that the nonhexosamine sugar of our gonadotropic hormone preparations consists entirely of galactose units. Obviously final proof of the nature of the carbohydrate must await its isolation and characterization. It must be further emphasized that the presence of several galactose units along with a single different hexose molecule would be extremely difficult to detect by the methods we have employed. However, we consider this possibility to be unlikely.

Further details of the above study will be published shortly.

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# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## INTRAVENOUS INFUSION PUMP[1]

FOR intravenous infusion in animals, it is desirable to have an automatic device which is simple, is easily adjusted to deliver various amounts and has a high degree of accuracy. The following apparatus seems to meet these requirements and is designed and used for the digitalis cat-assay. It consists essentially of a stopcock, turned by a constant speed motor, which in one position connects a pipette with a reservoir from which it is filled and in the other position connects the pipette with the vein into which it empties (see Fig. 1). The filling level (F) of the pipette is determined by the position of the reservoir. The emptying level (E) is determined by the position of a device which makes it independent of venous pressure variations, and which has been used in a perfusion method for isolated organs with constant volumes of fluid[2]: The venous canula is connected with the lower end of a vertical glass tube (25 cm length, 0.4 cm inside diameter), which has a short T arm sealed close to its open top. One opening of the stopcock is connected with this T arm, and the fluid (from the pipette) enters the glass tube, runs down along the walls of the tube, at the lower end of which it is collected as a fluid column which flows into the vein. (A wool thread in the glass tube, stretching

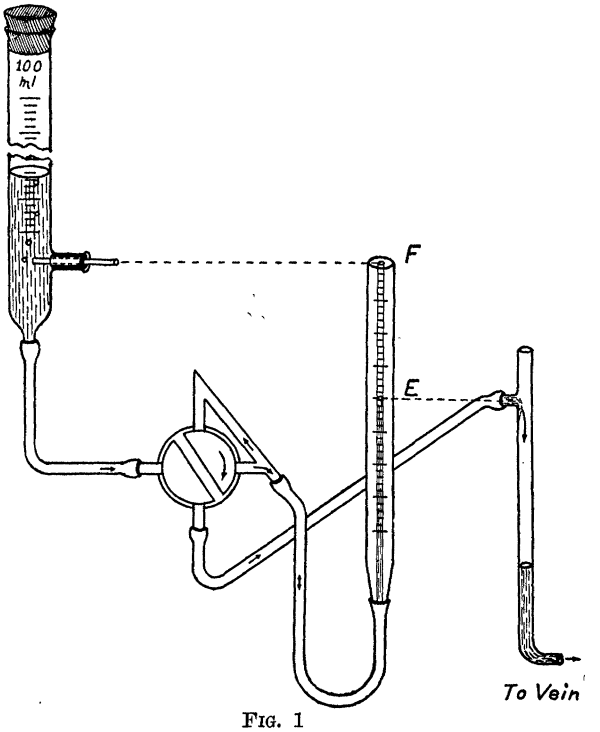


FIG. 1

[9] M. Sörensen and G. Haugaard, *Biochem. Zeit.*, 260: 247, 1933.

[1] Aided by a grant from the David Trautman Schwartz Research Fund and a grant to Dr. Erwin E. Nelson from the United States Pharmacopoeia XI Revision Committee.

[2] G. Katz, *Arch. Intern. Pharmacodyn. et Therap.*, 44: 1934, 239.