Buck[6] has recently synthesized a number of N-aryl barbituric acid derivatives, amongst which he included the following with dye-forming groups:

(1) 1-p-(phenylazo)phenyl-5,5-diethylbarbituric acid
(2) 1-p-(4-aminophenylazo)phenyl-5,5-diethylbarbituric acid
(3) 1-p-(2-azo-α-naphthol-5-sulfonic acid)phenyl-5,5-diethylbarbituric acid
(4) 1-p-(4-aminonaphthylazo)phenyl-5,5-diethylbarbituric acid
(5) 1-p-(4-hydroxynaphthylazo)phenyl-5,5-diethylbarbituric acid
(6) 1-m-(4-aminophenylazo)phenyl-5,5-diethylbarbituric acid
(7) 1-m-(2-azo-α-naphthol-5-sulfonic acid)phenyl-5,5-diethylbarbituric acid
(8) 1-m-(4-aminonaphthylazo)phenyl-5,5-diethylbarbituric acid
(9) 1-m-(4-hydroxynaphthylazo)phenyl-5,5-diethylbarbituric acid

These dyes have now been administered intraperitoneally into albino mice with the hope of inducing anesthesia.

The results obtained vary. Numbers 1, 2, 4, 6 and 8 induce true anesthesia, numbers 3 and 7 cause a mixed effect, a convulsive element apparently masking the anesthetic, and in the dosage range possible, numbers 5 and 9 are inert. Some of these compounds are amphoteric, but they are equally effective as anesthetics, whether dissolved with the aid of equivalent amounts of alkali or of acid. In general the meta isomers are more soluble than the para.

Certain animals were sacrificed during the early part of anesthesia or within an hour after injection of the various dyes. Gross anatomic examination of these animals uniformly showed, with the exception of the brains, generalized staining of the tissues, especially of the subcutaneous fat. Those dyes which induced anesthesia, however, not only stained the tissues as above but also stained the brain tissue. The other dyes stained brain tissue little if any. Apparently, therefore, there is a parallelism between the brain-staining properties of these dyes and their ability to induce anesthesia. These results promise to provide material for further investigations, such as histological studies, which are now in progress, quantitative determinations in the tissues, effects on cellular metabolism and their fates in the animal body, all of which may lead to a better understanding of the processes underlying the phenomenon of anesthesia.

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[6] J. S. Buck, *ibid.*, 58: 1284, 2059, 1936; 59: 1249, 1937.

DIFFRACTION OF X-RAYS BY BUILT-UP FILMS OF PROTEINS

THE method of building up successive layers of protein monofilms has been recently demonstrated by Langmuir, Schaeffer and Wrinch.[1] They further indicated the possibility of investigating the structure of these layers by means of x-rays. This investigation was carried out on films built up by the technique of Dr. Blodgett,[2] as modified by Clark, Sterrett and Leppla[3] in this laboratory.

A curved glass slide was used as a solid substratum on which to build the layers. Langmuir, Schaeffer and Wrinch found it preferable to employ a surface already covered with a number of layers of barium stearate, but for the purpose of the present study, in order to simplify the x-ray pattern, it was judged advisable to build up the protein layers directly on the glass itself. Layers of the AB type were added, the plate being dried between each addition of two protein layers. Only these recurrent AB films were used for the present x-ray investigation.

Preliminary x-ray photographs indicated that, unlike the built-up films of stearate, protein layers would, at the best, give only a few orders of a given spacing. They also showed a great deal of background fogging, making it advisable to adopt a vacuum camera technique.

Plates containing 30, 40 and 70 layers of egg albumin were prepared. The radiation was supplied by a Philips Metalix diffraction tube, operated at 28 KV and 20 ma., rendered monochromatic by use of a nickel foil. The sample to film distance was not obtainable in this case by the usual methods, as a curved plate was being used inside the vacuum camera designed by Schaad.[4] The photographic film was placed in two positions, a known distance apart, and two exposures made without altering the position of the sample. In this way it was possible to calculate the sample to film distance.

It was found that each sample gave a sharp diffraction arc, corresponding to a spacing of 73.3 A.U. The length of the arc indicates that this is not a highly oriented long spacing. In some cases it was possible to obtain a second order of this spacing.

According to Astbury and co-workers[5] the dena-

[1] Langmuir, Schaeffer and Wrinch, SCIENCE, 85: 76, January 15, 1937.
[2] Katharine Blodgett, *Jour. Am. Chem. Soc.*, 57: 1007, 1935.
[3] Clark, Sterrett and Leppla, *Jour. Am. Chem. Soc.*, 57: 330.
[4] J. A. Schaad, Thesis, University of Illinois, 1936.
[5] Astbury and Woods, *Phil. Trans.*, A 232, 333, 1933; Astbury and Lomax, *Jour. Chem. Soc.*, p. 846, 1936.

tured protein spread on the surface of the water should have a side-chain spacing of about 10 A.U. No spacing of this order of magnitude could be detected on the present x-ray patterns. On the other hand, a long spacing of the order found may well be in accord with the theory of protein structure which pictures them as polymerized cyclols, propounded by Dr. Wrinch.[6]

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A TUBULAR VACUUM TYPE CENTRIFUGE

THE air-driven vacuum type ultracentrifuge[1] has been found to be an efficient apparatus for purifying many different organic and inorganic materials. It has proven useful especially in the separation and purification of biological substances such as the so-called "macromolecular proteins."[2,3] In this work it is standard practice to centrifuge the liquid in a rotor the diameter of which is greater or approximately equal to its length. The rotor is supported in a vacuum chamber by a single flexible shaft which passes out of the chamber through a vacuum-tight gland and connects with an air-supported air-driven turbine above the chamber. The rotor is constructed to hold several test-tube containers for liquid and is equipped with a vacuum-tight cover.[2] Consequently, in making a single separation it is necessary for the operator not only to start and stop the centrifuge but to evacuate the chamber containing the rotor as well. Since the largest rotors[2,3] employed so far hold only from 120 to 150 cc, this procedure may become time-consuming if large quantities of material are to be centrifuged. Clearly, if the apparatus could be modified so that the materials could be passed continuously (or intermittently) through the centrifuge and the lighter and heavier fractions separately collected (in the manner of the familiar cream separator), without stopping the centrifuge or without lowering the efficiency of separation appreciably, the quantity centrifuged would be much increased.

In connection with a problem on the separation of gases (isotopes), we have been spinning long cylindrical tubes in such a manner that the gas enters at the top and is collected in two fractions at the bottom. Recently the same type of apparatus has been applied to the separation of liquids and has proven effective enough to warrant possibly a short description.

In Fig. 1 the cylindrical rotor (centrifuge) C is supported inside the vacuum chamber V by a stainless steel tube A (gauge 12).[4] A passes through the vacuum-tight gland G_1 and is attached to the air-supported air-driven turbine T. The construction and operation of this type of turbine and vacuum gland

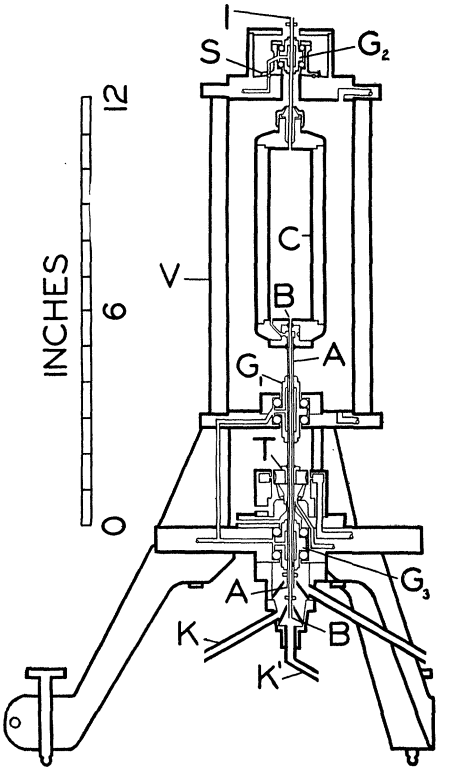

FIG. 1.

have been previously described.[1,5] A second stainless steel tube B (gauge 14 or 15) is mounted inside and coaxial with A in such a manner that A communicates with the periphery, while B connects with the axis of C. A third stainless steel tube I (gauge 15 or greater) is mounted above and in the axis of C as shown. I passes out of the vacuum chamber through the vacuum-tight oil gland G_2, which is mounted in a special self-aligning vacuum-tight bearing S. The bearing S consists of two carefully ground or lapped surfaces separated by a thin film of vacuum pump oil, continuously supplied under pressure, requiring a few cc per hour. Although this bearing is almost ideal for the purpose, it may be dispensed with by mounting G_2 in, for example, flexible rubber.

To operate the centrifuge, first, the chamber V is evacuated and the centrifuge accelerated to the desired

[1] Beams and Pickels, R. S. I., 6: 299, 1935.
[2] Bauer and Pickels, *Jour. Exp. Med.*, 64: 503, 1936; 65: 565, 1937.
[3] Wyckoff, SCIENCE, 86: 92, 1937.
[4] Obtained from the Jensen-Salsbery Inc., Kansas City.
[5] Beams and Linke, R. S. I., 8: 160, 1937.
[6] Dr. Dorothy Wrinch, *Proc. Roy. Soc.*, A 160, 59, 1937.