volume of 0.01 or 0.02 cc, is injected subcutaneously near the region of the future vaginal orifice and observations are made once daily. The first indication of a positive reaction consists of a crescent-shaped transverse dimpling of the skin at the developing vaginal orifice. Openings appear at various points in the crescent and fluid oozes at such slits from gentle pressure.

On the average it requires 4 or 5 days for the vaginae of two out of three animals to open; but easily recognizable changes appear usually within 24 hours. If large doses are used, for example, 0.005 mgm of estradiol diproprionate[1] in 0.02 cc of oil, the vagina may open within 24 hours and definite changes, easily recognizable at a glance, have been noted within 17 hours.

One of the chief objects in developing a delicate test for estrogen seemed to us to lie in its possible applicability to assays of estrogen in blood. To our amazement, if our calculations are even approximately correct, we found the test to be almost unbelievably sensitive to blood estrogens, for as little as 0.02 cc of untreated finger blood from women was always positive, while that from four different men was always negative.

For most of the experiments to date 21-day-old female rats have been used; but in one experiment six females of one litter of 16-day-old rats were used with such success that it seems possible that the 16-day-old rat may become the animal of choice for these experiments. The young were injected and returned to their mother. Within four days all the injected females had open vaginae: the two which had received 0.0005 mgm of estradiol in 0.02 cc of oil and the three that had received 0.02 cc of midcycle female blood. Within 30 hours the dimpling was observable. The one control showed no change.

How delicate this test really is, in terms of blood estrogen, is seen in the following calculation. Taking the recent figures of Markee and Berg[2] as a basis we find the midcycle titre of estrogen in the blood to be roughly 0.005 mgm per liter or 0.000005 mgm per cc. A positive reaction, involving anatomical changes, is thus attained with five one hundred millionth of a milligram of estrogen—which, however, still contains some billions of molecules.

The test, it is to be noted, costs nothing, for the test animals are not sacrificed, remaining perfectly normal members of a colony. Furthermore, the time required to make and read the test is almost negligible.

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[1] Generously furnished by Dr. E. Oppenheimer, research director, Ciba Pharmaceutical Products, Inc.

[2] J. E. Markee and B. Berg, *Stanford Med. Bull.*, 2: 55, 1944.

NORELAC—A SUBSTITUTE FOR SHELLAC IN THE PRESERVATION OF SMOKED PAPER RECORDS

NORELAC (*Northern Regional Lacquer*) is a new thermoplastic polymer developed at the Northern Regional Research Laboratory.[1] The properties of Norelac[2] and its solubility characteristics encouraged us to test its use as a substitute for shellac in the preservation of smoked-paper records, such as the kymograph records produced in physiological and pharmacological laboratories. The present war-time shortage of shellac has emphasized the need for a good substitute. Even when shellac is plentiful the preparation of a suitable coating for smoked records is something of a nuisance, and can not be done in a short time. A rather voluminous alcohol-insoluble residue must be allowed to settle and the supernatant solution decanted.

A few experimental trials with Norelac in a suitable solvent demonstrated readily that it can be substituted for shellac with complete satisfaction. A 5 per cent. solution of Norelac in a mixture of isopropyl alcohol and Skelly Solvent "C" (or naphtha) makes a good protective coating for a smoked-paper record. The record dries in ten minutes with a dull finish. If less than 5 per cent. of Norelac is used, abrasion marks are easily produced. If 10 per cent. of Norelac in isopropyl alcohol and Skelly Solvent "C" is used, the record dries free from tack in ten minutes with a glossy finish. The record can be given an intermediate degree of luster by the use of 7.5 per cent. of Norelac in a mixture of 75 to 85 parts of isopropyl alcohol and 25 to 15 parts of Skelly Solvent "C." The coating is applied to the smoked paper in the manner usually employed with alcohol solutions of shellac. The records coated with Norelac lie flat without curling, and can be stored flat or rolled without danger of sticking, marring or cracking. The addition of 1 to 2 per cent. of paraffin[3] will reduce any tendency to stick under unfavorable conditions of storage.

The sample of Norelac used had an iodine number of 89.2, indicating that there would be no danger of spontaneous combustion of stored records. A solution of Norelac has also been found suitable for protection of paper labels on reagent bottles and laboratory equipment.

It is convenient to prepare a stock 30 per cent. solution of Norelac in 99 per cent. isopropyl alcohol with the aid of heat, and to dilute as required for use to 5 or 10 per cent. or some intermediate concentration with a mixture of isopropyl alcohol and Skelly

[1] J. C. Cowan, A. J. Lewis and L. B. Falkenburg, *Oil and Soap*, 21: 101–107, 1944.

[2] Obtainable from General Mills, Inc., Minneapolis, Minn.

[3] J. C. Cowan, L. B. Falkenburg and A. W. Schwab, *Modern Packaging*, 17: 113–119, 1944.

Solvent "C." If the solution prepared for use contains more than 25 per cent. of Skelly Solvent "C" it tends to cause creeping of the carbon on the paper; and if the concentration of Skelly Solvent "C" is less than 15 per cent., the solution tends to cloud or deposit an amorphous precipitate. Solutions of 5 to 10 per cent. of Norelac and up to 25 per cent. of Skelly Solvent "C" tend to jell when stored at 5° C., but remain fluid at 20° C.

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DISCUSSION

BREAD "ENRICHMENT"

THE appearance of an article under the above title by Dr. E. V. McCollum[1] calls for a reply in view of Dr. McCollum's long-established eminence in the field of nutrition. We do not differ from Dr. McCollum in nutritional principles. We do differ strongly with him on the practical efficacy of his proposed approach to the problem of our bread (and flour) supply. The practical problems, as well as the nutritional aspects related to them, have been the subject of extended discussions in the Food and Nutritional Board ever since its oganization in November, 1940. Dr. McCollum has been present at many of these discussions, often as a silent listener, but this is the first time he has come out publicly in opposition to the judgment of the majority of the board.

Dr. McCollum's position on bread "enrichment" is unrealistic in respect to feasibility of achievement. He treats of bread with little recognition of the fact that there are several million Americans who do not regularly use bakery bread but homemade bread. There is a notably high incidence of deficiency disease in the "hot bread belt" of our South. This fact his article ignores. No adequate national program can be based on a consideration of bakers' bread only.

Dr. McCollum "would prefer to see bread improvement achieved by a legal requirement concerning the minimum skim milk solids to be included in bread." He does not say how he would apply it to homemade bread. This is a serious omission in view of the fact that the "hot bread belt" is also an area of low milk supply. The Food and Nutrition Board always has and continues to favor strongly the continuation and extension of the use of milk solids in baker's bread, a practise which was already widely in use before enrichment was inaugurated and which we confidently believe will continue in the future. Addition of milk to bread, however, does not significantly liberalize the supply of thiamine and niacin in the dietaries of low income groups, especially not in the South.

He says "'The bread program of Canada and England seems to me to be superior to our own." That of England is a war program born of the threat of a food blockade. It sought to stretch the supply of wheat which it might be possible to import and to use home-grown foods as far as possible. A reflection of this is the fact that Britain has prohibited the sale of any bread within 24 hours after it comes from the oven. To so limit the available supply of bread to a somewhat stale quality facilitated the nationally necessary substitution of potatoes for bread. No such condition applied in the United States and it is reasonable to suppose that it will not continue to apply in England. Will England's "long extraction" program survive in peacetime? Switzerland's very similar program of 1936–1937 failed within a year.

Canada's program was undertaken nearly simultaneously with our own and like our own was on a voluntary basis. Conditions of wheat supply also were similar to our own. Extent of success is measured by the comparative volumes of bread and flour affected, namely, about 7 per cent. of Canada's consumption versus 70 per cent. or more which had been affected by enrichment in the United States before January, 1943.[2] Dr. McCollum at a later point in his article admits by clear implication the present infeasibility of the Canadian program. He says "If the milling industry were decentralized and mills were located in the vicinity of all centers of population . . . the manufacture of . . . Canada Approved Flour . . . would be practicable." Does he feel that an impracticable program is "superior to our own"?

Dr. McCollum recommends the use of wheat germs, corn germs, yeast and soyflour as bread improvers. Their use has been advocated before and the products have their merits, but in no sense are they presently available as popularly acceptable substitutes for enrichment nor in significant quantities of adequately controlled quality. To advocate their use in lieu of enrichment would postpone indefinitely any effective action. Any systematic program of bread and flour improvement based on the use of these ingredients would be even more difficult to introduce than a general substitution of whole wheat flour for white flour. Either expedient is for reasons of custom and present business organization a generation or more away as a general remedy.

Dr. McCollum objects that "the name 'enriched' connotes a higher quality than the enriching ingredients confer upon white flour. . . . The term 'improved'

[1] *Bulletin of the Maryland State Health Department*, 17, No. 1, March, 1945.

[2] In January, 1943, War Food Order Number One made enrichment of all white pan bakers' bread mandatory for the duration of the war.