one component was demonstrated, since the solubility of this component was constant whether the solution was just turbid or whether a great excess of hormone was in suspension. These results, agreeing with the studies made with the Tiselius electrophoresis apparatus and the ultracentrifuge, furnish proof of the purity of the hormone by the only other available physical chemical test.

The results of analysis of one specimen of pure hormone were: carbon, 49.37 per cent.; hydrogen, 6.83 per cent.; nitrogen, 14.93 per cent.; ash, 0.93 per cent.

All the assays were performed in rats hypophysectomized at an age of twenty-one days. Injections were begun two days later and were given subcutaneously once daily for four days.[11] At necropsy, twenty-four hours after the last injection, the appropriate organs were weighed and then fixed in Bouin's fluid. Typical results are shown in Table 1. Owing

TABLE 1

Dose micrograms of nitrogen	Number of rats	Mean and S.E. of wts.		
		Body gm	Ant. lobe prostate mg	Testes mg
–	8	48.5 ± 2.90	8.49 ± 0.549	130.7 ± 5.25
1	9	52.4 ± 2.49	11.01 ± 0.695	142.0 ± 7.35
2	6	49.3 ± 3.62	16.97 ± 0.624	160.8 ± 12.10
10	5	44.9 ± 1.18	34.58 ± 2.130	209.6 ± 7.91

to stimulation of the testicular interstitial cells, 1 microgram of hormone nitrogen caused a significant increase in the fresh weight of the anterior lobe of the prostate ($P = < 0.05$ by Fisher's method of paired comparisons). A dose of 2 micrograms of hormone nitrogen was required to produce an increase of testicular weight ($P = < 0.05$). This testicular hypertrophy was probably caused chiefly by the action of secreted androgen on the germinal epithelium. In hypophysectomized, immature female rats, the hormone maintained the interstitial cells. However, if it was administered after follicle-growth had been stimulated by follicle-stimulating hormone, it caused the formation of corpora lutea perhaps preceded by ovulation. Our results indicated that the secretion of oestrogen did not occur following the injection of follicle-stimulating hormone into hypophysectomized rats, although the growth of histologically normal follicles was clearly present. If, however, interstitial cell-stimulating hormone was also administered, all the morphological phenomena of oestrus were provoked.

SUMMARY

Interstitial cell-stimulating (luteinizing) hormone was isolated from swine pituitary glands. This protein hormone, having a molecular weight of about 90,000 and an isoelectric point of pH 7.45, was shown to be pure by tests in the electrophoresis apparatus of Tiselius and in the ultracentrifuge as well as by its constant solubility. The hormone stimulated the interstitial tissue of the testis or ovary and caused the formation of corpora lutea provided that maturing follicles were present. Under the conditions described, its minimal effective total dose in hypophysectomized immature male rats was about 1 microgram of nitrogen or 6.7 micrograms of hormone. Extracts of swine pituitary with purely follicle-stimulating effects did not cause oestrus in immature hypophysectomized female rats unless luteinizing hormone was also administered.

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SYNTHESIS OF THE PYRIDINE ANALOG OF VITAMIN B_1

THE concept of isosterism as proposed by Grimm[1] and extended by Erlenmeyer[2] has recently attracted attention by its possible application with respect to the substitution of a pyridine nucleus for the thiazole component of the thiamine (vitamin B_1) molecule. As part of a general study of various pyridine derivatives in this laboratory, one of us[3] recently described the preparation of 2-(β-hydroxyethyl)-3-methylpyridine and the condensation of this substance with the pyrimidine component of thiamine. Meanwhile, others have reported the synthesis of what was assumed to be 2-methyl-3-(β-hydroxyethyl)-pyridine, and from this the preparation of a substance presumably isosteric with thiamine by condensation with the appropriate pyrimidine. Schmelkes[4] described an isosteric vitamin as well as the substances formed by condensation of what he believed to be 2-methyl-5-(β-hydroxyethyl)-pyridine with the thiamine pyrimidine. He reported anti-polyneuritic activity for the former. Baumgarten and Dornow[5] arrived at Schmelkes' anti-polyneuritic substance by a different route and reported its activity as being about one-twenty-sixth that of thiamine. However, in a later paper, Dor-

[11] Results of other investigators indicate that intraperitoneal injection would have provoked a greater response.

[1] Grimm, *Naturwiss.*, 17: 535, 557, 1929.

[2] Erlenmeyer *et al.*, *Helv. Chim. Acta*, 16: 733, 1381 (1933); 20: 1388 (1937) inter alia.

[3] Finkelstein and Elderfield, *Jour. Org. Chem.*, 4: 365, 1939.

[4] Schmelkes, SCIENCE, 90: 113, 1939; Schmelkes and Joiner, *Jour. Am. Chem. Soc.*, 61: 2562, 1939.

[5] Baumgarten and Dornow, *Ber.*, 73: 44, 1940.

now[6] showed that the assumed β-hydroxyethylpyridine derivative of both workers was in reality the α-hydroxyethyl derivative. The true isoster of thiamine has, therefore, not been described, and we wish to report its synthesis at this time.

Ethyl α-(β-ethoxyethyl)-β-aminocrotonate condenses smoothly with diethyl malonate in the presence of sodium ethoxide[7] to give 2-methyl-3-(β-ethoxyethyl)-5-carbethoxy-4,6-dihydroxypyridine. Elimination of the carbethoxy group in this substance by saponification and decarboxylation and of the hydroxyl groups by replacement by chlorine and subsequent catalytic reduction of the dichloropyridine gave 2-methyl-3-(β-ethoxyethyl)-pyridine (picrate, m. 63–64°; calculated for $C_{16}H_{18}O_8N_4$: C, 48.7; H, 4.6; found: C, 49.0; H, 4.4). Cleavage of the ether group in this compound gave 2-methyl-3-(β-hydroxyethyl)-pyridine, the position of the substituents in which was shown by oxidation to quinolinic acid. The pyridine crystallizes with one water from chloroform-petroleum ether, and the water is not lost on distillation at 0.5 mm. pressure. The hydrate melted at 61–62° (calculated for $C_8H_{11}ON \cdot H_2O$: C, 61.9; H, 8.5; found: C, 62.2; H, 8.8). The picrate melted at 123–124° (calculated for $C_{14}H_{14}O_8N$: C, 45.9; H, 3.9; found: C, 46.3; H, 4.1). The above pyridine was condensed with 2-methyl-5-bromomethyl-6-aminopyrimidine hydrobromide to give 1-[(4-amino-2-methyl)-5-pyrimidylmethyl]-2-methyl-3-(β-hydroxyethyl)-pyridinium bromide hydrobromide, the true pyridine analog of thiamine, which charred at 240–260° dec. (calculated for $C_{14}H_{20}Br_2N_4O.H_2O$: C, 38.4; H, 5.1; found: C, 38.5; H, 4.6).

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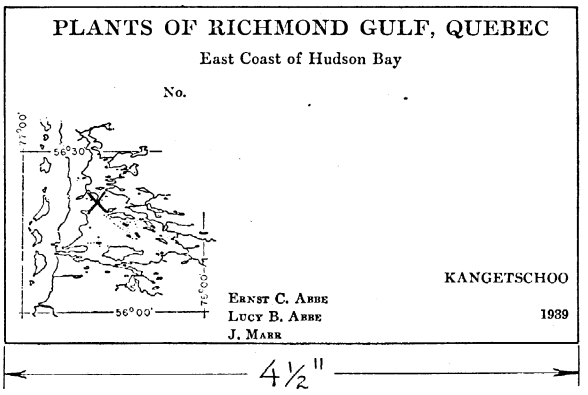
SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE USE OF OUTLINE MAPS ON HERBARIUM LABELS

THOSE who have had occasion to use herbarium specimens in distributional studies have experienced the aggravations attendant upon unsatisfactory definition of the localities listed on the labels. The problem affects not only ecological research and floristic plant geography, but also monographic taxonomy. In the experimental fields adjacent to taxonomy it is especially desirable to be able to return to the localities represented by herbarium specimens.

In regions which are well mapped, current practice often partially fulfils the above requirement through the indication of locality by township and range, by county or by latitude and longitude. Even greater precision would be desirable for some studies, such as in ecology and the genetical aspects of ecology and taxonomy.

For plants from regions which are poorly mapped or for which accurate maps are not generally available, such as that visited by the University of Minnesota Expedition to Hudson Bay,[1] there may be recommended the type of label illustrated in Fig. 1. The outstanding difference between this and the conventional labels is the inclusion of an outline map of the area, which results in a slightly larger than average size label (as indicated in the figure). There still remains generous space on the herbarium sheet for the plants and abundant space on the label for further data. The indication of the specific location at which the specimen was collected merely involves the insertion of a symbol (shown with an X in the figure) in the appropriate place on the outline map on the label. The added cost of this type of label is primarily accounted for by the cost of the zinc etching—in this case (at local prices) about $1.25. Thus the added cost per thousand labels is negligible.



The objection might be raised that a simple indication of latitude and longitude would be sufficient; but in poorly mapped regions an area may be very inadequately located with respect to the parallels of latitude and longitude. Furthermore, such regions are seldom shown in adequate detail even in the best atlases.

The locations of place names not given on standard maps and of places wholly lacking accepted names but to which temporary or local names have been given are clarified through the use of a map on the label. Such place names *may* be elucidated in diaries or in field note-books or in general accounts of collecting trips. Too frequently, however, these sources are not available to, or known by workers in the herbaria to

[6] Dornow, *Ber.*, 73: 353, 1940.
[7] Knoevenagel and Fries, *Ber.*, 31: 767, 1898.
[1] Abbe, SCIENCE, n. s., 90: 458, 1939.