tation for apple scab control must await the results of further experiments, which are in progress.

G. W. KEITT

UNIVERSITY OF WISCONSIN

SEEDS FOR THE STUDY OF ROOT AND ROOT-HAIR STRUCTURE IN BOTANICAL LABORATORIES

IN connection with studies made of the invasion of the bunch grass prairies by weeds, extensive germinations were made with *Bromus tectorum* L., one of the most common and abundant weeds invading deteriorated prairies in western Montana.

Under ordinary laboratory conditions, *B. tectorum* germinates easily in two days, giving usually from 90 to 98 per cent. germination. Its very fine single seminal root appears to me a most excellent material for the study of root-hair structure in undergraduate laboratories. All zones of the young primary root can be easily seen under both low and high powers of the microscope. The root-hairs stand out very clearly and prominently, giving a full series from the youngest epidermal cell just bulging out to the fully developed hair, in which streaming of protoplasm is usually evident.

A very convenient way, without the use of blotters, is to scatter the seed in the moist chamber, in which water has been poured to a depth of say one half to one mm. The chamber may be placed either in a lighted or in a darkened place; in two or three days the roots will be of the proper length. The seeds will also germinate if dropped in a tumbler-full of water.

I'll be glad to send on the receipt of a mailed and stamped envelope enough seed for any size class.

JOSEPH KRAMER

MONTANA STATE UNIVERSITY

SPECIAL ARTICLES

ACTION OF KETENE ON THE PITUITARY LACTOGENIC HORMONE

IN their study of the acetylation of pepsin, Herriott and Northrop[1] found that the primary amino groups play no significant role in the activity of the pepsin molecule. Later, White[2, 3] reached the same conclusion in a study of insulin and emphasized the importance of the tyrosine molecule in all hormones of protein nature. In contrast with their conclusions we have found that the primary amino groups in the lactogenic hormone appear to be important for its biological activity.

The lactogenic hormone contains 0.53 per cent. amino nitrogen, as determined by Van Slyke gasometric apparatus. Herriott and Northrop have shown that amino groups are acetylated by ketene at room temperature in not more than five minutes, whereas the phenolic hydroxyl groups remain unchanged.[4] We have also found that ketene treatment for five minutes at room temperature was sufficient to block all amino groups in the lactogenic hormone. If the reaction is carried out at 0° C, for five minutes, only 30 per cent. of the amino groups is acetylated. The acetylation is achieved by passing a constant stream of ketene into a suspension which contains 10 mg protein per cc in pH 5.6 M acetate buffer. Ketene is obtained by the improved type of generator designed by one of us.[5]

All ketene experiments were done with a preparation of lactogenic hormone (Li-P)[6] which, as Table I shows, gives a pronounced reaction when a total dose of 1 mg is injected intramuscularly into one-month-old squabs.

It will be seen from the results in Table I that the free amino groups in lactogenic hormone are essential for its activity. The results of the present work are in contrast with those secured by Stern and White[7] in the acetylation of insulin, and are especially interesting because of several striking similarities in the two hormones. Stern and White treated insulin with the same reagent—ketene—under conditions similar to those here employed, and found that the free amino groups of insulin played no significant role in its phar-

TABLE I

Lactogenic preparation (Li-P)	Amino groups acetylated per cent.	Dose/ Squab mg	Number of squabs	Crop sac reactions
Untreated	0	1.0	3	pronounced
Acetylated at 0° for 5 minutes	30	1.0	3	2 minimal 1 negative
Acetylated at 20° for 5 minutes ...	100	1.0	6	negative
	100	4.0	6	negative

[1] R. M. Herriott and J. H. Northrop, *Jour. Gen. Physiol.*, 18: 35, 1934–35.

[2] K. G. Stern and A. White, *Jour. Biol. Chem.*, 122: 371, 1938.

[3] A. White, Cold Spring Harbor Symposia on Quantitative Biology, 6: 262, 1938.

[4] There is as yet no experimental evidence to show that the phenolic hydroxyl of tyrosine in the lactogenic hormone is also important for its biological activity.

[5] C. H. Li, SCIENCE, this issue, page 143.

[6] The authors are most grateful to Dr. W. R. Lyons for the potent preparation of lactogenic hormone employed. The minimal effective dose was 0.2 mg when divided into four daily doses and administered intramuscularly. We have had the opportunity of studying a similarly potent preparation of adrenotropic hormone, due to the kindness of W. R. Lyons and H. D. Moon. The activity of adrenotropic hormone is not destroyed by ketene by five minutes of treatment. This method may conveniently eliminate the lactogenic activity in adrenotropic fractions.

[7] *Loc. cit.*

macodynamic action. These groups are essential for the activity of the lactogenic hormone.

CHOH HAO LI
MIRIAM E. SIMPSON
HERBERT M. EVANS

INSTITUTE OF EXPERIMENTAL BIOLOGY,
UNIVERSITY OF CALIFORNIA,
BERKELEY

THE EFFECT OF COCARBOXYLASE UPON METABOLISM AND NEURO-PSYCHIATRIC PHENOMENA IN PELLAGRINS WITH BERIBERI[1]

THE present communication is a report of observations on eight selected cases of pellagra with beriberi which were studied from chemical, neurological and psychiatric standpoints. Preceding and following the administration of cocarboxylase, each patient was studied repeatedly by the following methods: (1) Analysis of blood samples for metabolites, including sulfite combining substances. (2) Neurological examination, including chronaximetric measurement. (3) Estimation of the psychiatric status.

The intravenous administration of 50 milligrams of cocarboxylase (Merck) to persons who exhibited signs of an "active process" was followed, in every instance, by dramatic and rapid improvement. The bisulfite-binding substances decreased in quantity. The pathological signs of peripheral and cranial nerves, which had become increased in patients who were being treated with nicotinic acid and riboflavin, became less conspicuous or disappeared. The irritability of a number of muscles, measured in terms of their strength-duration curves, returned from underexcitability before treatment to normal values and in some cases even progressed to overexcitability. Correspondingly, the increased threshold of sensibility to touch and prick in arms and legs was reduced to normal, and the depressed pupillary and corneal reflexes improved quantitatively, often becoming normal.

Following the administration of cocarboxylase, some beneficial effect occurred, in some persons within an hour and in all persons within four hours. Improvement continued for from one to four days thereafter. Since the unbalanced diets of these persons remained essentially unchanged, in the absence of further therapy the patients tended to regress rapidly to their condition preceding treatment. A psychoneurotic syndrome which was recognized in these persons and which responded promptly to the administration of cocarboxylase will be described separately. In contrast, in the persons selected for control, there was no decrease of bisulfite-binding substances in the blood and no improvement in the neurological and psychoneurotic symptoms following cocarboxylase therapy.

The present study shows that the neuropathy accompanying pellagra represents a clinical entity (beriberi), distinct from a deficiency of nicotinic acid or of riboflavin. It shows also that cocarboxylase (pyrophosphate of thiamin) has a striking effect upon certain intermediate products of carbohydrate metabolism and induces improvement in the affected peripheral and cranial nerves. Furthermore, the decrease of bisulphite-binding substances in the blood is accompanied by a decrease or disappearance of certain neurological signs and of psychoneurotic symptoms.

F. H. LEWY
MEDICAL COLLEGE OF THE UNIVERSITY OF PENNSYLVANIA

H. E. HIMWICH
ALBANY MEDICAL COLLEGE

J. P. FROSTIG
UNIVERSITY OF CALIFORNIA

T. D. SPIES
UNIVERSITY OF CINCINNATI COLLEGE OF MEDICINE

EVIDENCE FOR THE EXISTENCE OF A RESPIRATORY NEUROHORMONE

IN the course of studies on the pressor effects of acetylcholine, it was observed that amounts of acetylcholine which produce pressor effects and contraction of the nictitating membrane also increase the rate and depth of respiration for brief intervals. It was also observed that the larger the dose of acetylcholine the longer the duration of respiratory stimulation and the greater the depth of respirations. The pressor effect always outlasts the respiratory stimulation.

The minimum amounts of acetylcholine producing respiratory stimulation in atropinized dogs and cats are 0.15 to 0.2 mgm or more per kilogram, but in the presence of optimum amounts of eserine (about 1.5 mgm per kilogram) as little as 0.005 mgm of acetylcholine may produce respiratory stimulation. If 0.05 mgm of acetylcholine is used throughout in atropinized animals, the smallest dose of eserine which is required to produce respiratory stimulation from this amount of acetylcholine is 0.04 to 0.05 mgm per kilogram. In the same animals doses of epinephrine which produced blood pressure elevation and withdrawal of the nictitating membrane also caused a decrease but never an increase in the rate of respiration.

In five cats and eight dogs the carotid sinuses were removed and in some of these animals the vagi above the ganglia nodosa as well as the sympathetics above the superior cervical ganglia were sectioned. In these animals, which were treated with atropine and eserine,

[1] From the Department of Neurosurgery, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania; Department of Physiology and Pharmacology, Albany Medical College, Albany, New York; Department of Psychiatry, University of California, Berkeley, California; and Department of Internal Medicine, University of Cincinnati General Hospital, Cincinnati, Ohio. This study was aided by grants from the Child Neurology Research (Friedsam Foundation) and from the Rockefeller Foundation.