seedlings compared with the values for the grass at the end of the 28-day period.

Both pine seedling estimates are weighted by data from the 64-day harvest, in contrast to the 28-day harvest of the grass. Microbial synthesis and possibly chemical exchange as well would have continued through the intervening period, gradually reducing the specific activity of phosphorus available from inorganic forms. The slopes of the regressions are further diminished by the lowered phosphorus content of nonresponding plants. Allowance for these factors indicates fair agreement between the respective values for pine and grass.

Thus it appears that in each of the four combinations of soil and fertilizer, Italian rye grass and mycorrhizal pine seedlings utilized the added inorganic phosphorus and native sources to a very similar degree. It may be concluded that the mycorrhizal roots possessed no exceptional facility for utilizing phosphorus from the soil organic matter.

References and Notes

* Present address: Department of Agronomy, North Carolina State College, Raleigh.

1. A. B. Hatch, *Black Rock Forest Bull.* **6**, 1 (1937); H. L. Mitchell, R. F. Finn, and R. O. Rosendahl, *Black Rock Forest Papers* **1**, 58 (1937); A. L. McComb, *Iowa Agr. Expt. Sta. Research Bull.* **314**, 1 (1943); A. L. McComb and J. E. Griffith, *Plant Physiol.* **21**, 11 (1946).
2. E. L. Stone, *Soil Sci. Soc. Amer. Proc.* **14**, 340 (1950).
3. J. B. Routien and R. F. Dawson. *Am. J. Botany* **30**, 440 (1943).
4. E. Melin and H. Nilsson, *Physiol. Plantarum* **3**, 88 (1950).
5. C. McAuliffe *et al.*, *Soil Sci. Soc. Amer. Proc.* **12**, 119 (1947); R. S. Russell, J. B. Rickson, and S. N. Adams, *J. Soil Sci.* **5**, 85 (1954).
6. D. D. Johnson and F. E. Broadbent, *Soil Sci. Soc. Amer. Proc.* **16**, 56 (1952).
7. M. Peech and L. English, *Soil Sci.* **57**, 167 (1944).
8. R. H. Bray and L. T. Kurtz, *Soil Sci.* **59**, 39 (1945).
9. The radiophosphorus was obtained from the U.S. Atomic Energy Commission.
10. R. E. Kitson and M. G. Mellon, *Ind. Eng. Chem. Anal. Ed.* **16**, 379 (1944).
11. C. McAuliffe, *Anal. Chem.* **21**, 1059 (1949).
12. P. J. Kramer and K. M. Wilbur, *Science* **110**, 8 (1949).

16 July 1954.

Separation of *dl-cis* from *dl-trans* Labeled and Unlabeled Chrysanthemumic Acids on Paper

Fred Acree, Jr., and Frank H. Babers

Entomology Research Branch,
Agricultural Research Service,
U.S. Department of Agriculture, Beltsville, Maryland

Carbon-14 labeled *dl-cis,trans*-allethrin has been synthesized (*1*), and its physiological and insecticidal behavior in houseflies and cockroaches is now being investigated (*2*). Obviously, the value of this investigation would be greatly increased by the comparison of the eight isomeric labeled allethrins with one another.

The unlabeled compounds have been prepared from the isomeric chrysanthemumic acids and allethelones following their resolution by standard chemical techniques (*3*). Because only 2 g of the *dl-cis,trans*-2 C^{14} chrysanthemumic acid was available to us, other methods of separation were required, and a method applicable to microgram quantities was very desirable. The first step toward such a procedure has been accomplished by the successful separation on paper of the *dl-cis* from the *dl-trans* chrysanthemumic acid.

The solvent was prepared by shaking 50 parts of isopropyl acetate with 25 parts of 10-percent aqueous ammonium hydroxide. The mixture was then allowed to stand in the chromatographic chamber overnight for separation and for saturation of the atmosphere. Saturation was facilitated by hanging wide paper strips in both layers of the solvent mixture. Whatman No. 1 paper in 1-in. strips was drawn once through 1-percent aqueous ammonium chloride and air-dried in the hood. Five to 20 μg of both labeled and unlabeled *dl-cis,trans*-chrysanthemumic acids and also of authentic samples (*4*) of *dl-cis* and *dl-trans* acids (mp 115° to 116° C and mp 51° to 54°C, respectively), were applied to separate strips of paper. The strips were irrigated for approximately 4 hr by ascension of the organic layer of the solvent mixture. The strips were then air-dried, and the zones of ammonium salts were located with the potassium permanganate and benzidine sprays applied as described by Winteringham (*5*).

The developed chromatograms of the *dl-cis,trans*-chrysanthemumic acids had dense zones of Rf 0.37 and 0.60 (*6*) and, by comparison with the developed chromatograms of the authentic samples, these zones were found to be *dl-trans* and *dl-cis* acids, respectively. On standing, the polarity of the solvent increased, owing apparently to slight hydrolysis of the isopropyl acetate. As a consequence these Rf values gradually shifted during a 2-wk period to 0.51 and 0.72, respectively. This change in no way interfered with the use of the procedure, particularly when authentic samples were run simultaneously.

In addition to the zones of *dl-cis* and *dl-trans* acids, zones of Rf 0.0–0.01, 0.20, and 0.98 have been observed. The zones of Rf 0.0–0.01 and 0.98 have been common to all chromatograms that contained *dl-trans* acid. The zone of Rf 0.20, although visible only in chromatograms obtained from 20-μg samples of *dl-cis,-trans* acid, was detected radiometrically in the labeled product. The zone of Rf 0.98 also was obtained on all chromatograms of the *dl-cis* acid, but it occurred to a lesser extent in the authentic samples than in the *dl-cis,trans* acids. Although the zone of Rf 0.98 was detectable on strips run as blanks and was probably due partly to traces of impurities in the solvent, there is no doubt that additional material traveled to this zone when the acids were chromatographed. The presence of materials having these Rf values has also been demonstrated in a commercial sample of *dl-cis,trans*-chrysanthemumic acid.

To learn more about the impurities, unsprayed chromatograms from 20-μg samples of labeled acid were sectioned according to sprayed duplicates and

the substances were eluted with 70-percent ethanol containing a few drops of dilute ammonium hydroxide. Radiometric measurements were made on the air-dried residues in comparison with similarly treated but unchromatographed standards. The average counts per minute (in parentheses), corrected for background, from six replications were as follows: standard (124), Rf 0.0–0.01 (8), Rf 0.18–0.20 (13), Rf 0.4–0.5 (48), Rf 0.6–0.7 (31), Rf 0.98 (10), total recovered (110). The origin and the nature of the zones of impurities cannot be explained from the data available at the present time.

References and Notes

1 Fred Acree, Jr., C. C. Roan, and F. H. Babers, *J. Econ. Entomol.*, in press.
2. The radioactive C^{14} used in these investigations was obtained on authorization from the U.S. Atomic Energy Commission.
3. I. Campbell and S. H. Harper, *J. Chem. Soc.* 283 (1945); *J. Sci. Food Agr.* **4**, 189 (1952).
4. These samples were kindly furnished by M. S. Schechter of this Branch.
5. F. P. W. Winteringham, *Science* **116**, 452 (1952).
6. Rf is the ratio of the distance traveled by the substance to the distance traveled by the solvent.

30 September 1954.

Physiological Evidence Concerning Importance of the Amygdaloid Nuclear Region in the Integration of Circulatory Function and Emotion in Man

William P. Chapman, Heinz R. Schroeder, Georg Geyer, Mary A. B. Brazier, Charles Fager, James L. Poppen, Harry C. Solomon, Paul I. Yakovlev

Department of Psychiatry, Harvard Medical School, Boston Psychopathic Hospital; Medical and Neurological Services, Massachusetts General Hospital; Departments of Medicine and Neurology, Harvard Medical School, Boston

Preliminary findings presented in this paper (*1*) suggest that in man the amygdaloid nuclear complex, situated in the temporal lobe, may play a role in circulatory regulation as well as in emotional expression. The observations were made in five epileptic patients in each of whom a multiple electrode, consisting of four parallel needles, had been implanted in the amygdaloid region of one temporal lobe by a specially modified stereotaxic apparatus. Three of the needles were of equal length and spaced 5 mm apart in the position of an equidistant triangle, while the fourth was 3 mm shorter and was located in the center of this triangle. This electrode was used to record the electric activity, to stimulate this region, and finally to coagulate this nuclear area for therapeutic purposes. The amygdaloid area was localized by measurements derived from skull x-rays of the clinoids in each patient and from air studies of the tip of the temporal horn in all except one case.

Preliminary studies with the stereotaxic instrument in 11 cadavers using the same skull landmarks revealed that our centrally placed electrode needle entered the amygdaloid nuclei in nine cases and missed this structure by 1 mm in two cases. Since we have no tissue specimens in any of our patients for the determination of the precise location of the electrodes, we have defined the area studied as the amygdaloid nuclear region, meaning thereby, the area in or near the amygdaloid nuclei.

Three patients were diagnosed as having epilepsy with assaultive behavior of such severity as to necessitate confinement in a psychiatric institution. Two patients had a diagnosis of psychomotor (temporal lobe) seizures of incapacitating severity. All had electroencephalographic abnormalities in the temporal area before operation. The amygdaloid region was coagulated in the patients with assaultiveness in an attempt to modify favorably this behavior, and in the patients with psychomotor epilepsy, to avoid greater destruction by temporal lobe extirpation, such as is used in some centers in the treatment of that condition. In each case, a group of psychiatrists had recommended surgical treatment after all attempted medical therapy had failed. The extent of the lesion caused by the current parameters used for coagulation had been previously determined in 12 cats. The results of coagulation will not be reported until sufficient time has elapsed for clinical evaluation to be meaningful. Electric stimulation was employed in an attempt to obtain a clearer understanding of the functions of the amygdaloid region, including its role in our patients' illnesses. The effects of electric stimulation of the amygdaloid region on feeling states and the continuous recording of blood pressure and heart rate were studied, and the electric activity from this region and from the scalp was recorded at various intervals during a 7 to 9 day period prior to the therapeutic electric coagulation procedure.

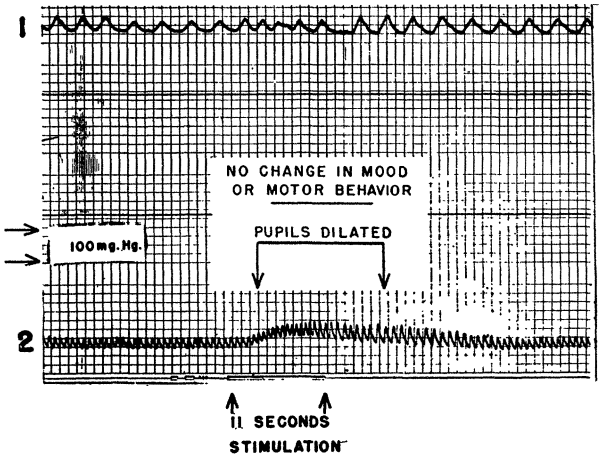

Fig. 1. Electric stimulation caused a 50 mm-Hg rise in systolic and 33 mm-Hg rise in diastolic blood pressure and pupillary dilatation without producing mood or somatic responses. (1) Respiratory tracing. (2) blood pressure tracing; 60 pulses/sec, 1 msec pulse duration, 12 v.