determined by use of a Welch densichron No. 2150 with a green N filter.

The data are shown in Table 1. Each value is the mean of 14 determinations except in the case of serine, where only 10 determinations were used. Only 12 of the possible 18 amino acids identified in the concentrated filtrate were critically measured. The data show that all the free amino acids measured were significantly decreased in the treated samples, with the exception of glutamic acid. Glutamic acid in the treated samples showed a significant increase over the controls.

TABLE 1

EFFECT OF 2,4-D TREATMENT ON FREE AMINO ACIDS IN TUBERS OF RED MCCLURE POTATOES*†

Spot No.	Amino acids	Mean densichron units: Treated	Mean densichron units: Control	Diff	Standard deviation	Standard error	Min diff req for significance: .05	Min diff req for significance: .01
1	Isoleucine phenylalanine	1.63	1.95	0.32	0.13	0.04	0.03	0.04
2	Valine, γ amino butyric acid	2.06	2.35	.29	.18	.05	.14	.19
3	Lysine	1.46	1.58	.12	.14	.04	.11	.15
4	Glutamine, alanine	2.47	2.82	.35	.14	.04	.11	.15
5	Threonine	1.40	1.58	.18	.10	.03	.08	.11
6	Asparagine	1.78	1.93	.15	.10	.03	.08	.11
7	Serine	1.46	1.56	.10	.03	.03	.08	.11
8	Glutamic acid	2.68	2.47	.21	.15	.04	.12	.16
9	Aspartic acid	2.07	2.17	0.10	0.12	0.03	0.09	0.12

* Arginine, proline, histidine, tyrosine, methionine sulfoxide, and cysteic acid, although identified by two-dimensional chromatograms, appeared in concentrations too small to measure.

† Concentrated filtrates were used on one-dimensional chromatograms for this table.

Complete details of this work and its significance in the interpretation of the mechanism of 2,4-D action are being published elsewhere.

References

1. BORTHWICK, H. A., HAMNER, K. C., and PARKER, M. W. *Botan. Gaz.*, **98**, 491 (1937).
2. ERICKSON, L. C., SEELY, C. L., and KLAGES, K. H. *J. Am. Soc. Agron.*, **40**, 659 (1948).
3. HAMNER, C. L. *Botan. Gaz.*, **103**, 374 (1941).
4. MITCHELL, J. W., and BROWN, J. W. *Ibid.*, **107**, 120 (1945).
5. RAKITIN, YU. V., and TROYAN, A. V. *Doklady Akad. Nauk. S.S.S.R.*, **66**, 483 (1949).
6. RASMUSSEN, L. W. *Plant Physiol.*, **22**, 377 (1947).
7. RHODES, A., TEMPLEMAN, W. G., and THURSTON, M. N. *Ann. Botany*, **54**, 181 (1950).
8. SELL, H. M., *et al. Plant Physiol.*, **24**, 295 (1949).
9. SMITH, F. G. *Ibid.*, **23**, 70 (1948).
10. SMITH, F. G., HAMNER, C. L., and CARLSON, R. F. *Ibid.*, **22**, 58 (1947).
11. SMITH, O., NASH, L. B., and DAVIS, G. E. *Botan. Gaz.*, **102**, 206 (1940).
12. STAHLER, L. M., and WHITEHEAD, E. I. *Science*, **112**, 749 (1950).
13. STUART, N. W. *Botan. Gaz.*, **100**, 298 (1938).
14. PAYNE, M. G., *et al. Am. Potato J.*, **28**, 455 (1951).
15. MORROW, C. A., and SANDSTROM, W. M. *Biochemical Laboratory Methods*. 2nd ed. New York: Wiley, 183 (1935).
16. CONSDEN, R., GORDON, A. H., and MARTIN, A. J. P. *Biochem. J.*, **38**, 224 (1944).
17. DENT, C. E., STEPKA, W., and STEWARD, F. C. *Nature*, **160**, 682 (1947).

The Growth of Peanut Plants at Various Diurnal and Nocturnal Temperatures

William P. Jacobs

Department of Biology,
Princeton University, Princeton, New Jersey

While doing research on other problems of peanut development at the California Institute of Technology, the opportunity was taken of studying the effects of controlled temperatures on the growth of the improved Valencia variety of *Arachis hypogaea* L. Although large-scale experiments were not carried out under the two colder night temperatures, the observed differences were so marked and clear-cut that it seems worth while to report them.

The air-conditioned greenhouses at the California Institute of Technology have been described by Went (*1*). Peanut seeds were germinated outdoors in early September, and 16 plants were moved into the greenhouse on October 2, 1945, when the mean height of each replicate was 1.4 in. measured from the cotyledonary node to the distal attached edge of the stipules on the topmost extended leaf. Groups of four plants were placed under each of the temperature combinations indicated in the first column of Table 1. All plants had 8 hr of daylight and were grown in coarse sand watered twice daily with Hoagland's nutrient solution. The growth after 2 weeks is shown in Table 1. At this time all leaves of 26°-day plants were a healthy dark-green and were about 2 in. long. The younger leaves of the 18°-day plants were all yellow, none exceeding 1.3 in. in length.

Although the first flower appeared by October 17 on a 26°-day: 30°-night plant, by November 7 the 26°-day: 27°-night plants had an average of 4 gynophores/plant contrasted to only 1 gynophore/plant for the 26°-day: 30°-night plants. The latter showed markedly greater vegetative growth, however. No flowers appeared on the 18°-day: 16°-night plants during the 4 months of the experiment. Although a few flowers with unelongated calyx tubes appeared on the 18°-day: 22°-night plants after November 16, no gynophores developed from the 18°-day plants during the ensuing 4 months. (The developmental anatomy and physiology of the gynophore are described by Jacobs [*2, 3*].)

The results with peanut plants agree with those of

TABLE 1

VEGETATIVE GROWTH OF PEANUT PLANTS UNDER VARIOUS TEMPERATURE COMBINATIONS

Temperature: Day	Temperature: Night	Mean height (inches)	Mean number of branches
26°	30°	2.8	9.3
26	27	2.6	8.0
18	22	1.7	5.5
18°	16°	1.7	5.0

Went on tomatoes (*4*) and those of Dorland and Went on chili peppers (*5*) as far as vegetative growth is concerned. Thus, the peppers showed greatest vegetative growth, while still small, at 27°-day: 30°-night. Young tomato plants also showed maximum stem elongation at the highest pair of temperatures tested (27°-day: 27°-night).

The gynophore of the peanut has no close parallel in tomatoes or peppers, being most conveniently considered a stage intercalated between flower development and fruit development. Correspondingly, the evidence concerning a temperature optimum for growth of the gynophore finds no parallel in published results on flower or fruit development in tomatoes and pepper.

References

1. WENT, F. W. *Am. J. Botany,* **30**, 157 (1943).
2. JACOBS, W. P. *Ibid.,* **34**, 361 (1947).
3. *Ibid.,* **38** (in press).
4. WENT, F. W. *Ibid.,* **31**, 135 (1944).
5. DORLAND, R. E., and WENT, F. W. *Ibid.,* **34**, 393 (1947).

The Antimicrobial Principle of *Clematis Dioscoreifolia*

Werner Herz, Anne Louise Pates, and Grace C. Madsen

Department of Chemistry, The Florida State University, Tallahassee

In the course of a survey designed to test green plants of this region for antimicrobial activity, it was noted that freshly prepared aqueous extracts of *Clematis dioscoreifolia* showed unusually strong activity against gram-positive and gram-negative bacteria and thus resembled a number of other species of Ranunculaceae tested previously (*1*). The activity was maintained for more than two months of storage in a refrigerator but diminished quickly at room temperature. Extracts of plant material from dried leaves were inactive.

Extraction of the aqueous solution with a variety of organic solvents, of which ethyl acetate appeared to be the best, caused the activity to move into the organic layer. In an attempt to isolate the active principle, the aqueous solution resulting from the extraction of approximately 1 kg of freshly picked plant was extracted with ethyl acetate. Removal of the organic solvent at reduced pressure, followed by several recrystallizations of the residual gum from a mixture of ethyl acetate and ligroin, yielded 204 mg of shiny white plates (mp, 151° C), which were shown to be identical with anemonin (*2, 3*) by analysis, color reactions, and mixed melting point.[1]

The distribution of anemonin in a number of Ranunculaceae has been discussed recently (*4*). Since the solutions used in our work possessed the extremely irritating properties of protoanemonin commented upon by other workers (*2, 3*), there can be little doubt that protoanemonin is responsible for the antimicrobial activity of *Clematis dioscoreifolia,* but dimerized to the inactive anemonin under the conditions employed for its isolation.

[1] We wish to thank Beatrice C. Seegal and S. Raymond for an authentic sample of anemonin.

References

1. OSBORN, E. M. *Brit. J. Exptl. Path.,* **24**, 227 (1943).
2. ASAHINA, Y., and FUJITA, A. *Acta Phytochim. (Japan),* **1**, 1 (1922).
3. BAER, H., HOLDEN, M., and SEEGAL, B. C. *J. Biol. Chem.,* **162**, 65 (1946).
4. KROEBER, L. *Pharmazie,* **4**, 181 (1949).

The Chemical Kinetics of Procaine and Chloroprocaine Hydrolysis

Manuel Aven and Francis F. Foldes

Departments of Anesthesia of the Mercy Hospital and University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania

Kisch (*1*) in 1943 reported his studies on procaine esterase. Since that time a number of microanalytical methods have been recommended for the determination of procaine and *p*-aminobenzoic acid in biological fluids. A reliable and simple method was described by Ting *et al.* (*2*). The authors of this paper have shown that Ting's method is also applicable to 2-chloroprocaine[1] and 2-chloro-4-aminobenzoic acid (*3*). Ting's method was utilized in the study of the chemical kinetics of the alkaline and enzymatic hydrolysis of procaine and chloroprocaine reported in this paper.

Bullock (*4*) demonstrated the instability of alkaline-buffered procaine solutions and measured the rate of decomposition of procaine at various pH's and temperatures. Although no actual mention is made in his paper of the kinetics of the reaction, the data presented seem to indicate that the alkaline hydrolysis of procaine is a first or second order reaction.

To study the alkaline hydrolysis, solutions containing around 4×10^{-4} moles/l of procaine or chloroprocaine and 7×10^{-4} moles/l NaOH were incubated at

TABLE 1

THE RELATIONSHIP BETWEEN TIME AND THE QUANTITY OF PROCAINE AND CHLOROPROCAINE HYDROLYZED IN ALKALINE MEDIA

Time (min)	Quantity procaine hydrolyzed (moles/l × 10^5)			Quantity chloroprocaine hydrolyzed (moles/l × 10^5)		
	Exp 1	Exp 2	Exp 3	Exp 1	Exp 2	Exp 3
30	5.2	8.0	7.9	12.0	13.2	9.4
60	10.3	12.8	13.1	21.2	21.8	16.4
90	16.4	17.4	17.5	27.2	27.5	22.0
120	20.1	21.8	21.8	30.6	30.3	25.2
150	24.1	25.3	24.6	32.1	32.2	27.8
180	27.2	28.5	27.2	33.5	33.7	29.7
210	—	31.0	29.5	—	34.3	30.7
240	—	32.8	32.8	—	34.6	32.0

[1] The chloroprocaine and the 2-chloro-4-aminobenzoic acid were supplied through the courtesy of L. Reiner, of Wallace and Tiernan Products, Belleville, N. J.