The —SH and —S—S— values are listed in Tables 1 and 2. From these data the following conclusions may be drawn: (1) Significant amounts of —SH were found in all horny structures studied. (2) The rigid chemical distinction between hard and soft keratins on the basis of their sulfur content appears somewhat abitrary. Keratins form a series which contains transitional types. An example of such a transitional type is that found in the horse burr, heretofore considered a prototype of soft keratins. The horse burr is phylogenetically a rudimentary hoof, its keratinization differs histologically from epidermal keratin formation and chemically it resembles hard keratins by virtue of its horny layer having a higher disulfide content than its Malpighian layer. (3) The disulfide content of the Malpighian layer of the sole is in the same range as in the horny layer. This finding supports the theory that epidermal keratinization[3] starts in the depth of the Malpighian layer (*12*).

References

1. WALKER, E. *J. Physiol.* (*London*) **59**, 32 (1924).
2. KAYE, M. *Biochem. J.* (*London*) **18**, 1289 (1924).
3. GIROUD, A., and BULLIARD, H. *La keratinisation de l'epiderme et des phaneres.* Paris: G. Doin, 1930.
4. GIROUD, A., and LEBLOND, C. P. *Ann. N. Y. Acad. Sci.* **53**, 613 (1951).
5. MESCON, H., and FLESCH, P. *J. Invest. Dermatol.* **18**, 261 (1952).
6. BARRNETT, R. J. *J. Natl. Cancer Inst.* **13**, 905 (1953).
7. FLESCH, P., and KUN, E. *Proc. Soc. Exptl. Biol. Med.* **74**, 249 (1950).
8. ALEXANDER, P. *Ann. N. Y. Acad. Sci.* **53**, 653 (1951).
9. DU VIGNEAUD, V., MILLER, G. L., and RODDEN, C. J. *J. Biol. Chem.* **131**, 631 (1939).
10. BLOCK, R. J., and BOLLING, D. *The Amino Acid Composition of Proteins and Foods,* 2nd Ed. Springfield, Ill.: Thomas, 1950.
11. VAN SCOTT, E. J. *J. Invest. Dermatol.* **18**, 377 (1952).
12. CARRUTHERS, C., and SUNTZEFF, V. *Physiol. Revs.* **33**, 229 (1953).
13. ZINGSHEIM, M. *Deut. med. Wochschr.* **77**, 1630 (1952).

[3] Differences between normal and pathologic human keratinization, confirming and extending Zingsheim's data (*13*) will be reported elsewhere.

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Isolation of *Histoplasma capsulatum* from the Air

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An epidemic of histoplasmosis in a farm family in Kansas following cleaning of an unused chicken house offered an excellent opportunity to sample the air for the presence of this organism. *Histoplasma capsulatum* had been isolated from the debris in the chicken house and from soil just outside. The infection had also been demonstrated in animals.

Another opportunity was provided in western Missouri when a soldier suffered an attack of severe pulmonary histoplasmosis after cleaning a chicken house.

TABLE 1.

Location	Date	Length of sampling time (hr)	Height of sampler opening from floor (ft)	Result
Atchison, Kansas	12–11–52	1.5	5	Neg.
	1–27–53	1.5	5	Neg.
	2–18–53	1.5	5	Neg.
	3–13–53	1.5	5	Neg.
	4–14–53	6.0*	2	Pos.
Beverly, Missouri	10–31–52	1.5	2	Neg.
	7– 8–53	9.0*	2	Neg.
	7– 8–53	4.5	5	Neg.
	7–17–53	8.0*	2	Pos.
	7–17–53	4.0	5	Pos.
	7–23–53	12.0†	2	Neg.
	7–29–53	13.5†	2	Pos.
	8– 6–53	9.0*	2	Pos.

* Combination of 2 simultaneous samples.
† Combination of 3 simultaneous samples.

H. capsulatum had been demonstrated in the debris in this chicken house also.

The atmosphere in these chicken houses was repeatedly sampled with portable Venturi scrubber air samplers (*1, 2*). The samplers were operated at 16 cfm. The plane of the Venturi opening was perpendicular to the ground. The debris on the floor of the chicken houses was not disturbed during the sampling period. The organisms in the distilled water in which the air was washed were collected by using the Goetz Millipore filter and injected into Swiss white mice. Sterile equipment and technique were employed throughout. Five of thirteen samples were shown to contain *H. capsulatum.* Details of the sampling are summarized in Table 1.

References

1. JONES, W. P. *Ind. Eng. Chem.* **41**, 2424 (1949).
2. COLLINS, T. T., JR., SEABORNE, C. R., and ANTHONY, A. W., JR. *Paper Trade J.* **124**, 45 (1947).

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Auxin-florigen Balance in Flowering of Soybean[1]

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Since Dostál and Hosek (*1*) first showed that flowering of plants could be delayed or prevented by growth hormone, or auxin, there has been an increasing feeling that auxin may be antagonistic to the postulated flowering hormone, or florigen. Bonner and Thurlow (*2*), Galston (*3*), and Leopold and Thimann (*4*) have observed tendencies toward flowering in plants held on noninductive photoperiods and treated

[1] Journal paper No. J-2383 of the Iowa Agricultural Experiment Station, project 1139.

TABLE 1. Percentage flowering of soybean plants treated with auxin or anti-auxin.

Treatment	Lincoln		Ogden	
	18-hr day, 75 days old	16-hr day, 85 days old	14.5-hr day, 100 days old	16-hr day, 120 days old
Control	0	11	0	0
Nicotine sulfate	56	100	67	33
Auxin	0	0	0	0
TIBA	58	—	—	—

with "anti-auxins," or significant increases in flower number from such treatments in plants receiving minimum photo-induction.

The behavior of the midseason soybean variety Lincoln, under certain conditions, has led us to conduct an extensive study of hormone balance and flowering in this and the later variety Ogden. Spraying 1- to 2-month-old Lincoln or Ogden plants with a nicotine sulfate spray at a concentration of about 2000 ppm has caused the production of abundant and apparently normal macroscopic flowers under noninductive treatments (Table 1). The appearance of these plants suggested that the nicotine was acting as an "anti-auxin." The "anti-auxin" 2,3,5-triiodobenzoic acid (*3*) was accordingly used in the same way, at 10 ppm. Inhibition of new growth and formation of macroscopic flowers on noninducted plants were again observed in clear-cut experiments. "Anti-auxin" treatments induced earlier flowering or flowering when the controls remained vegetative, flowering at lower nodes, and more flowers per node (Table 2).

Under conditions of good light and moderate fertility, Lincoln soybeans were observed to flower on 18-hr photoperiods when 3–4 months old. Borthwick and Parker (*5*) have noted a tendency for older larger soybean plants to flower on days too long for flowering of younger or more vigorous plants. If we assume that a flowering hormone produced in older leaves (*6, 7*) is antagonized by growth hormone produced in apical meristems and young leaves (*8*), we would expect this late-flowering response in plants that continue to produce mature leaves from an essentially unchanging apical region. The ratio of florigen-producing tissue to auxin-producing tissue would eventually become great enough to cause flowering in plants in which rapid destruction of florigen was not induced by long photoperiods. Comparisons of the area of mature and of expanding leaves at the time of the appearance of macroscopic flowers showed a ratio of 5 to 1 in Lincoln soybeans on 11.5-hr photoperiods, increasing to 15 to 1 on 18-hr photoperiods. Ratios were reduced toward the short-day level by the "anti-auxin" treatments (Table 2). Control plants of Ogden flowered at the 7th node on a 14.5-hr photoperiod with a leaf-area ratio of 19 to 1, and did not produce macroscopic flowers on longer photoperiods; but nicotine-treated plants flowered on a 16-hr photoperiod with a ratio of 16 to 1.

TABLE 2. Lincoln soybeans, 120 days.

Treatment	Photoperiod			
	16 hr	14.5 hr	13 hr	11.5 hr
Lowest flowering node				
Control	6.9	5.2	4.0	3.6
Nicotine sulfate	3.9	3.6	3.1	3.0
Avg. no. flowers per node				
Control	2.3	2.5	2.9	3.0
Nicotine sulfate	4.0	4.1	4.6	5.0
Ratio of mature to immature leaf area at flowering				
Control	14.7	11.5	8.2	5.0
Nicotine sulfate	8.5	6.5	5.7	4.2

As a further test of the ratio hypothesis, apical buds or immature leaves were removed from Lincoln plants of varying age and size. Removal of the bud forced axillary growth and delayed or prevented flowering. Continued removal of immature leaves as they formed forced young plants into early flowering on 18-hr photoperiods (Table 3). Spraying immature leaves with "anti-auxin" was more effective in inducing flowering than spraying entire plants, and was much more effective than spraying only mature leaves.

TABLE 3. Defoliation and flowering of Lincoln soybean on 18-hr photoperiods.

Treatment	Percentage flowering, days			Lowest flowering node
	77	84	91	
Control	0	0	33	5.6
One mature leaf removed	0	0	17	5.5
Immature leaves removed*	33	100	100	2.0

* All embryonic leaves removed after 4th trifoliate leaf matured.

Spraying with auxin delayed flowering of these plants only when total growth was greatly reduced, and the delay is considered to have been a general rather than a specific effect. Lighter auxin treatments of plants previously treated with nicotine sulfate hastened and increased flowering. This result would be expected if auxin may be inhibiting for floral induction but is necessary for growth of flowers.

Much evidence has accumulated that plants must attain a certain size before they are affected by induction treatments. Purvis and Gregory (*9*) called this stage the ripe-to-flower condition. Although many interacting factors are possible, the size factor in cabbage (*10*) and celery (*11*) appears to be the area of mature, and presumably florigen-producing, leaves.

Our data provide clear-cut support for a theory of hormone control in flowering. They do not differentiate between a balance of auxin and florigen or a balanced level of auxin alone, controlled by hormone production and the production of a natural "anti-auxin" such as Roberts (*12*) has isolated from flowering plants. The varying responses of *Xanthium* and soybean, for example, may indicate that the flowering hormone is actually some "anti-auxin," and that the growth hormone is an antiflowering hormone when present in more than optimum concentration. At still lower concentrations, auxin may limit flowering because it is present in insufficient concentration to support the essentially vegetative growth of flower parts (*4*).

References

1. DOSTÁL, R., and HOSEK, M. *Flora* **131**, 263 (1937).
2. BONNER, J., and THURLOW, J. *Botan. Gaz.* **110**, 615 (1949).
3. GALSTON, A. W. *Am. J. Botany* **34**, 356 (1947).
4. LEOPOLD, A. C., and THIMANN, K. V. *Ibid.* **36**, 342 (1949).
5. BORTHWICK, H. A., and PARKER, M. W. *Botan. Gaz.* **101**, 341 (1939).
6. CHOLODNY, N. G. *Herbage Revs.* **7**, 223 (1939).
7. HAMNER, K. C., and BONNER, J. *Botan. Gaz.* **100**, 388 (1938).
8. AVERY, G. S., JR., BURKHOLDER, P. R., and CREIGHTON, H. *Am. J. Botany* **24**, 51 (1937).
9. PURVIS, O. N., and GREGORY, F. G. *Ann. Botany (London)* **1**, 569 (1937).
10. BOSWELL, V. R. *Proc. Am. Soc. Hort. Sci.* **22**, 380 (1925).
11. THOMPSON, H. C. Cornell Univ. Agr. Expt. Sta. Bull. No. 480 (1929).
12. ROBERTS, R. H. *Science* **117**, 456 (1953).

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Comments and Communications

On Geochemical Effects of Freezing

IT has been shown that growing ice as it forms from dilute (10^{-2} to 10^{-6} *M*) solutions of many ionic compounds selectively incorporates ions of one sign into the nascent surface layers (*1, 2*). The effect is sensitive to the nature and abundance of ions in the solution, but it is readily exhibited by a number of different inorganic salts which have been tried in laboratory samples. As the ice surface develops beyond the point of attachment of the impurity ion, the space charge in the ice and in the solution is neutralized by the circuitous passage of a counter electric current, leaving the impurity centers distributed uniformly throughout the bulk ice. In many freezing situations the process produces an effective chemical action due to the primary ion separation, and to the associated electrochemical action of the current in the unfrozen electrolyte.

A consideration of the geochemical significance of these phenomena as they occur in nature should not be overlooked. The alkali halides in solution are such as to give conditions of high selectivity in the process, and CsF will serve to illustrate the action and indicate the quantities involved.

A solution of CsF (10^{-5} *M*) will result in the placement of approximately 10^{16} fluoride ions per cubic centimeter of ice, rejecting almost completely the cesium ions. Calculations yield the following quantities.

Population of fluoride ions relative to water molecules in the ice	$1:3\times10^6$
H_2 liberated/m^3 of ice frozen	1/120 gmol
O_2 liberated/m^3 of ice frozen	1/240 gmol
Number of repeated freezings required to dissociate ⅓ of the water involved	10^6
Depth of world ice formation to liberate H_2 equal to that present in the atmosphere (optimum conditions)	3 m

These effects may influence also the presence of heavy ions in terrestrial waters where freezing occurs. Consider, for example, a solution of cupric halides. Many conditions of freezing in nature will provide a suitable electrode configuration to effect an electrolytic deposition of copper from the solutions. Such depositions of copper may be responsible for some native copper occurrences.

In attempting to estimate the geochemical consequences of natural freezing, it is important to point out that knowledge of the processes here suggested has been developed for the most part from laboratory tests on controlled impurities. The measurements which are made on growing ice in the laboratory are sensitive to types of impurities and to certain contaminants such as excess CO_2 which prevent or obscure the action illustrated. Sea water has been used in laboratory tests, however, and the basic electrical manifestations have been verified for this substance. One can say with reasonable certainty that the freezing of water is a significant agency for influencing the concentration and nature of the solute materials of terrestrial water.

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References

1. WORKMAN, E. J., and REYNOLDS, S. E. *Phys. Rev.* **78**, 254 (1950).
2. SCHAEFER, V. J. *Ibid.* **77**, 721 (1950).

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Optical Masking Device for the Aminco-Stern Electrophoresis Apparatus

THE photographic recording of electrophoretic patterns is often impeded merely because of the optical properties of the material under examination. Thus, in blood serum, portions of the curve may be almost invisible due to coloration caused by partial hemolysis, or the albumin peak may be so sharp that it is impossible to obtain a photograph which includes the tip of the peak without overexposing the remainder of the curve. A system which allows for masking of