of the source was 2×10^6 times as great as the average energy from the entire disk at 480 megacycles. This region crossed the central solar meridian on May 11.5 in latitude 18° S. An intense magnetic storm began at 06: 24 May 12, 34 hours 22 minutes after the flare, during an interval when disturbance had been forecast by the Central Radio Propagation Laboratory.

This occurrence supports previous evidence that great flares and severe fadeouts start very nearly simultaneously. The observation that the times of maximum intensity of the bursts of solar noise at 480 and 160 megacycles coincide to within a few seconds differs from the condition observed with the lesser bursts. That this time of maximum intensity is also very nearly the time of maximum absorption is further evidence that the radiation which ionizes the absorbing layer varies in intensity similarly to radiation in the H_α and the 480- and 160-megacycle regions.

TECHNICAL PAPERS

Low Temperature Studies with Colloidal Silicic Acid

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A number of observations have been made in this laboratory during the past two years pertaining to the thermal behavior of silica sols which appear to be related to the properties of ice. The following gives a brief summary of the findings. More detailed reports will be published elsewhere.

The effect of freezing on the stability of colloidal silicic acid is known to be related to pH (*4*). An extension of the study to liquid air temperatures has revealed that the rate of thawing may have a profound effect with systems frozen at temperatures below about − 55° C (e.g. at − 65° or in liquid air). When thawed rapidly by immersing the containing vessels (test tubes) in water at room temperature the colloidal system remains stable. However, when the same system is thawed slowly in air at room temperature it coagulates.

An explanation of this phenomenon may be that the ice lattice is more disordered when formed by rapid freezing below about − 55° C than it is when formed above this temperature. Freezing the colloidal system in liquid air produces a solid system which approaches an amorphous condition (*2*). At temperatures higher than about − 55° C the ice lattice is more orderly and this causes the colloidal particles to be coagulated when they are crowded together into pockets.

When the system described above is frozen by immersion in liquid air and thawed slowly, the solid state is retained long enough above − 55° C for well-defined crystals to form. This results in the dehydration of the colloidal particles in the pockets which serve as loci for coagulation. Under conditions of rapid thawing the more stable lattice does not have a favorable opportunity to form, hence freezing and thawing do not produce coagulation under these conditions.

It has been demonstrated in a striking way that this fundamental change can occur in the solid state. A sol frozen in liquid air may be held for an undetermined length of time at temperatures below about − 55° C (e.g. at − 65° or in liquid air), and it will not coagulate if it is thawed rapidly. However, when the sol is frozen in liquid air and then transferred to a temperature above − 55° C, but substantially below the melting point, e.g. − 35° C, and held at this temperature for 15 min it coagulates irrespective of the rate of thawing. Fifteen min is a relatively short time and it is apparent that the disoriented lattice is metastable with respect to the crystalline lattice.

These observations tend to clarify the reported behavior of a variety of different systems and to strengthen the view that the properties of ice at different temperatures may be a determining factor in the stability of a colloidal system. Thus, it has been reported that hemoglobin and vanadium pentoxide sols coagulate when frozen at − 5°, − 15°, and − 21° C but not at − 190° C (*1*). The rate of thawing of synthetic rubber dispersions frozen at − 60° C has been found to have a similar marked effect on the amount of coagulation (*5*).

It is tempting to correlate the behavior described with the fact that the dielectric constant of ice diminishes abruptly at about − 55° C (*3*). On the basis of free rotation of the water molecule, it can be said that at about − 55° C a polymorphic transition from a fine ice structure with a disoriented lattice (not a glassy state) to a more orderly lattice with a higher lattice energy occurs. It is the condition of the ice above − 55° C which is responsible for the precipitation phenomena. The lattice energy under these conditions is sufficient to overcome the solvation energy.

Additional information concerning this complex behavior has been obtained by observing the freezing precipitation in the presence of alkali metal halides. Some success has been had in correlating the effect of these ions on orientation of the water molecule by hydration with their influence on the amount of coagulation during freezing. As predicted, coagulation varies with salt concentration and goes through a minimum at low concentrations. Under favorable conditions coagulation can be entirely inhibited. These effects would appear to have various biological applications.

References

1. Djatschkowsky, S. J. *Kolloid Z.*, 1932, **59**, 76.
2. Dorsey, N. E. *Properties of ordinary water-substance.* New York: Reinhold, 1940. P. 397.
3. *Ibid.*, p. 503.
4. Hazel, F. *J. Phys. colloid Chem.*, 1947, **51**, 415.
5. Walker, H. W. *J. Phys. colloid Chem.*, 1947, **51**, 451.

Antithiamine Effect of Oxythiamine and Neopyrithiamine. A Comparative Study[1]

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According to Wilson and Harris (*3*), pyrithiamine does not have the structure assigned to it. These workers have synthesized a new compound which they call "neopyrithiamine," and which shows chemical and physical properties that would be expected from the pyridine analogue of thiamine. When this compound became available,[2] an experiment was set up with a view of comparing its antithiamine effect with that of oxythiamine, which was shown in this laboratory to act as an antagonist for thiamine (*2*).

Mice of the Swiss and C-57 Black strains from our stock colony were used. The animals were placed at weaning on a thiamine-deficient diet which consisted of casein (Labco) 25%, sucrose 53%, hydrogenated vegetable oil 10%, lard 5%, Osborne and Mendel salt mixture[3] 5%, and Ruffex 2%, and contained the following supplements per kg of diet: riboflavin 10 mg, pyridoxin 10 mg, calcium pantothenate 100 mg, α-tocopherol 40 mg, β-carotene[4] 20 mg, vitamin D (Drisdol) 5000 units, and choline chloride 1.5 g. When the animals had become steady in weight, they were maintained on 1 μg of thiamine per day, injected in aqueous solution subcutaneously for one week. Daily injections of oxythiamine or neopyrithiamine were then started together with 1 μg of thiamine in a ratio (thiamine: antivitamin) of 1:50. Control animals, three for each group, received thiamine alone. The results are shown in Table 1.

In the case of both compounds the effect on the food intake was apparent overnight. There was a drop in the food intake of the animals and a loss in weight. The data show that the antivitamin effect of neopyrithiamine is more pronounced than that of oxythiamine. This manifested itself in the development of polyneuritic symptoms in the animals treated with neopyrithiamine and in a shorter survival period. The polyneuritic syndrome was similar to that described by Morris (*1*). In addition, we observed that the mice were apt to hold their heads on one side, and that they developed complete paralysis of the hind legs. The controls maintained their weight, and they survived until they were sacrificed two weeks after the last animal in the corresponding experimental group had died.

TABLE 1

Comparative Antithiamine Effect of Oxythiamine and Neopyrithiamine

Substance tested	No. of mice	Wt of mice at start of injections of antivitamin g	Incidence of polyneuritis %	No. of days before polyneuritis developed	Survival time in days
Oxythiamine	9	10.6–13.6	0	. . .	13–21
Neopyrithiamine	9	10.2–13.8	100	5–7	7–8

References

1. Morris, H. P. *Vitamins and Hormones*, 1947, **5**, 175.
2. Soodak, M. and Cerecedo, L. R. *J. Amer. chem. Soc.*, 1944, **66**, 1988; *Fed. Proc.*, 1947, **6**, 293.
3. Wilson, A. N. and Harris, S. A. Amer. Chem. Soc. Abstr., Washington meeting, Sept. 1948.

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[1] This investigation was aided by grants from the National Institutes of Health and the John and Mary R. Markle Foundation.

[2] We are indebted to Dr. K. Folkers of Merck & Co., Inc. for the neopyrithiamine.

[3] The quantity of manganese was doubled.

[4] A mixture of 90% beta and 10% alpha carotene (GBI) was used.

Mechanical Transmission of a Plant Tumor Virus to an Insect Vector[1]

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Most plant viruses transmitted by leafhoppers have not been demonstrated to be infective in extracts. The virus dealt with in this paper causes tumors in certain susceptible plants, is carried by leafhoppers, and like others in that group has proven difficult to detect in extracts. It is our purpose to recount briefly the variety of methods that failed to transmit the virus and to report on the success of insect-to-insect transmission by injection.

The virus, known as wound-tumor virus, *Aureogenus magnivena* Black (*2*), is transmitted from plant to plant by the leafhoppers *Agalliopsis novella* (Say), *Agallia constricta* Van Duzee, and *Agallia quadripunctata* (Provancher). Attempts by the authors to transmit the virus

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[1] This work was supported in part by a grant from the American Cancer Society in accordance with a recommendation by the Committee on Growth, National Research Council.

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