experiment can be performed without light as well, there is evidence of motion of matter under the influence of homogeneous magnetic fields in both directions in darkness too. It is remarkable that one can easily distinguish two kinds of motion if one makes the field slightly non-homogeneous, by putting the plates at a very slight angle. While all ferromagnetic particles move in the direction of the denser lines of force (M. Faraday[8]), thus laterally and non-reversibly with the field, some of them, the charged ones, at the same time also show a superposed motion towards the plates, reversing this motion with the reversal of the field. Instead of placing the particles on the basis of the magnetrodes one can suspend them in gas in the space between the plates and observe in very diffused light a movement towards both plates, which in many cases was reversed with the reversal of the field.

Moreover, even in liquids one can observe such movements, which can only be explained if one assumes the existence of magnetic charges. Colloidal particles, for example, of Ni[9] or powdered particles suspended in various liquids, such as water, castor oil and glycerine, move, when exposed to the influence of homogeneous magnetic fields, toward the gold-plated magnetrodes and are finally deposited on them.

This is evidence that there is a phenomenon analogous to the well-known phenomenon of electrophoresis (cataphoresis)[10] and which should be termed "magneto-phoresis." The micro-photographs show that the deposits are coagulated in similar manner as the deposits of electrophoresis. It is also possible to observe the movement of individual particles under the influence of homogeneous magnetic fields as well as homogeneous electric fields independent of each other. These observations showed that the particles behaved similarly in both fields. However, the difference could be particularly well noticed on Cu particles which moved only in electric fields, but not in magnetic ones and on some iron particles which moved in magnetic fields but not in electric ones.

In order to explain all the phenomena which one can observe on magnetic ions one has to make similar assumptions as in the interpretation of phenomena on electric ions (f.i. change of charge, space charges and double layers). Thus, the changes of direction and of velocity occurring frequently and spontaneously during the observations must be explained as changes of magnetic charge. Up to the present, artificial change of magnetic charge could be achieved by means of irradiation by light and by the application of friction. However, irradiation with radium which changed the electric charge easily did not alter the magnetic charge at all.

The discovery of magnetic ions led to the conclusion that Ampere's[11] hypothesis, stating that every magnet can be substituted in its effects by circular electric currents, can not be considered as valid in general any more, since one can not apply it to bodies, where an excess of magnetic charge has been proved by means of such simple experiments as were described above. It also led to the conclusion of the existence of the magnetic current mentioned before.

The unit of the magnetic current is defined as the flow of the unit of true magnetism through the unit of cross-section during the unit of time. It is understood that the unit of true magnetism is the magnetic charge which exerts a force of one dyne on an equal one placed at the distance of 1 cm in the vacuum.

Other experiments and important conclusions will be reported later.[12]

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NEW STEREOISOMERS OF METHYLBIXIN

THE pigment from the seeds of the Annato tree (*Bixa orellana* L.), bixin, $HOOC \cdot C_{22}H_{26} \cdot COOCH_3$, and its methylester, methylbixin, $CH_3OOC \cdot C_{22}H_{26} \cdot COOCH_3$, differ from most natural polyenes in their stereochemical configuration. It was found by earlier investigators[1] that Bixa pigments are labile forms which can be converted into the corresponding stable isomers by iodine, irradiation, etc. Therefore, the natural product and its ester must contain at least one *cis* double bond. Despite the elapse of a decade no further progress has been reported in this field. So far as we know, not even the reversibility of the conversion mentioned has been claimed.

In experiments carried out recently in these laboratories it was shown that numerous stereoisomers of natural[2] and synthetic[3] polyenes can be obtained in a

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[7] De la Hire, Memoir de l'Acad. Roy. des sciences des Paris, anno 1717.

[8] M. Faraday, *Exp. Res. in Electr.*, etc., Vol. III, XXI, 8455, 1855.

[9] F. Ehrenhaft, *Akad. Anzeiger d. K. Ak. d. Wiss. Wien*, July 10, 1902, No. XVIII.

[10] F. F. Reuss, Mem. Soc. Imp. des Naturalistes de Moscou, 2, 327, 1809.

[11] J. M. Ampere, "Exposé de Nouv. dec. sur. l'electr. et le magnet." Paris, 1822.

[12] The experiments described above were carried out at Carl Zeiss, Inc., New York, N. Y., where they can be demonstrated by the authors.

[1] P. Karrer, A. Helfenstein, R. Widmer and Th. B. van Itallie, *Helv. chim. Acta*, 12: 741, 1929; R. Kuhn and A. Winterstein, *Ber.*, 66: 209, 1933 and 67: 344, 1934; P. Karrer and U. Solmssen, *Helv. chim. Acta*, 20: 1396, 1937.

[2] L. Zechmeister, A. L. LeRosen, F. W. Went and L. Pauling, *Proc. Nat. Acad. Sci.*, 27: 468, 1941; A. L. LeRosen and L. Zechmeister, *Jour. Am. Chem. Soc.*, 64: 1075, 1942; L. Zechmeister and W. A. Schroeder, *Jour. Am. Chem. Soc.*, 64: 1173, 1942.

[3] L. Zechmeister and A. L. LeRosen, SCIENCE, 95: 587, 1942.

reversible way. The methods used, especially iodine catalysis and melting of crystals, are now being applied to methylbixin. We have found that the *cis-trans* conversion mentioned above is reversible, and furthermore that not a single compound but a complicated equilibrium mixture of stereoisomers is formed. The latter can be separated on a Tswett column, using calcium carbonate (Merck's Heavy Powder) and benzene-petroleum ether mixtures.

So far 8 stereoisomeric methylbixins have been observed on the column, above and below the all-*trans* zone; of these several have been crystallized. They differ spectroscopically by 0–16 mμ from the all-*trans* compound which possesses the longest wave-length maxima (490, 457 mμ in petroleum ether). On addition of iodine the spectra of all these stereoisomers shift to about 488.5, 455 mμ.

A new type of rapid isomerization was observed with fresh methylbixin solutions at 20°. No all-*trans* isomer was present in this equilibrium, and it appeared only upon iodine addition.

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SEAWEEDS AT BEAUFORT, NORTH CAROLINA, AS A SOURCE OF AGAR

RECENT articles on methods for reclaiming used agar, on preparation of agar substitutes, and on means of conserving agar give evidence of the increasing concern over future sources of supply, especially for bacteriological requirements.

Agar has been produced commercially on the California coast for a number of years, and this production has been increased considerably during the past few months. However, agar for bacteriological purposes apparently is not being produced along the Atlantic coast. The long-established "Irish moss" industry of Massachusetts seems to be the nearest approach to the production of bacteriological agar in the eastern United States.

On June 1, 1942, an investigation of possibilities of producing agar from seaweeds of the North Carolina coast was begun at the Duke University Marine Laboratory at Beaufort, N. C. Although this work is still in its early stages, it has seemed advisable to announce certain findings because of the pressing need for new sources of agar.

The plans of this work include a systematic test of all the more common, larger species of red algae of the Atlantic coast from Beaufort southward to the Florida Keys but especially in the vicinity of Beaufort.

The most common red alga in certain parts of the Beaufort region during summer is *Gracilaria confervoides* (L.) Greville. Hoyt[1] states that it is present from April to November and that this species has been used "for the making of jellies in a way similar to the use of the 'Irish moss,' *Chondrus crispus,* of our northern coast." Preliminary tests indicate that from 25 to 35 per cent. of the air-dry weight of this alga is agar. Its wet weight is about 17 times that of the dry weight. Agar has been produced from this species at the Duke University Laboratory since about June 15 and has satisfactorily met bacteriological requirements.

The method of preparation used is similar to that given by Field.[2] Freshly collected material is washed with sea water and spread out to dry and bleach. From three days to a week are required for this process. Daily sprinkling with sea water is necessary to make bleaching complete. Whether or not the material is damaged by washing or wetting with fresh water has not yet been determined. When bleached and dry the seaweed is boiled in about 50 times as much fresh water by weight as seaweed. This is kept up to or above 50 per cent. of its original volume by occasionally adding more water during the boiling process. The liquid is then strained through several thicknesses of linen cloth and poured into shallow pans to cool and solidify. From this point on it is treated in a manner similar to that described by Thaller[3] for reclamation of used agar and a reasonably pure product is obtained. A 1.5 per cent. solution forms a sufficiently hard gel in a Petri dish to permit streaking with an inoculating needle.

If a purified agar is not required, 20 grams of dried Gracilaria may be placed in a cloth bag in a flask containing 500 or 600 cc of water (with nutrients if desired). This is autoclaved and the agar solution poured directly into Petri dishes for use.

Gracilaria confervoides is present in certain areas near Beaufort in large quantities and it can be collected with ease. In more favorable localities one person can gather 100 pounds wet weight of this material in an hour. There are many square acres of bottom that produce this alga in such abundance during summer months. Preliminary studies on the possibilities of cultivation of Gracilaria have shown a remarkable growth rate. Small stems about three inches long tied to pieces of tile and placed in a favorable habitat increased about ten-fold in two weeks during July.

Probably the second most common red alga of the Beaufort region during summer is *Hypnea musciformis* (Wulfen) Lamouroux. It is present the year

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[1] W. D. Hoyt, *Bull. Bureau Fisheries* (*U. S.*), 36: 367–556, 1917.

[2] I. A. Field, Econ. Circ. No. 51, Bureau of Fisheries (U. S.), 1921.

[3] H. I. Thaller, SCIENCE, 96: 23–24, 1942.