(6) From the data obtained relative to humidity, temperature, foot-candles of illumination and potential differences in leaves of plants (sunflowers) growing outdoors, it is concluded that these electromotive forces between base and tip of leaves are due chiefly to infra-red radiations.

(7) When an external and constant electromotive force is impressed on the leaf across the two electrodes, the values of the currents in the circuit including the leaf are increased by either ultra-violet or infra-red radiation or the values of the resistances are decreased.

(8) No measurable changes in currents under an impressed electromotive force are produced in leaves when exposed to various regions of visible light.

(9) Leaves may be darkened or tanned by ultra-violet or infra-red radiations. The character of the bronzing or tanning effect is apparently somewhat different in the two cases. Both ultra-violet and infra-red rays, however, possess the ability to fix the chlorophyll in the tissues, probably by disruption of cells and localized dehydration of surface tissues.

(10) From these experiments and other investigations which have been conducted on germination of seeds, growth of plants and development of chlorophyll, we conclude that the phenomenon of growth is evidenced, in part at least, by changes in electromotive force, and is largely dependent on and stimulated by the ultra-violet and infra-red regions of sunlight. The visible portions of sunlight are used, in all probability, for the development of chlorophyll.

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THE MANGANESE CONTENT OF THE MISSISSIPPI RIVER WATER AT FAIRPORT, IOWA

THE fact that the normal growth of plants, in many instances, depends on the presence of small amounts of certain metals is fast becoming apparent. Felix (1927)[1] reported that the application of copper improved certain muck soils on which onions and lettuce were raised. Brenchley (1910)[2] found that manganese stimulated the growth of barley, and Deatrick (1919)[1] found that manganese prevented chlorosis in wheat.

It was with these results in mind that the writer undertook to investigate the manganese content of the Mississippi River water at Fairport, Iowa. The Mississippi River furnishes the water for the fish ponds at this place. It was thought that possibly manganese might be a limiting factor in the production of algae in the fish ponds.

In Table I are given the results of some manganese determinations made during the summer of 1929. The results show that while the quantity varies considerably from time to time, there is always an appreciable amount of manganese present. It does, therefore, not seem likely that manganese was a limiting factor.

TABLE I

SHOWING AMOUNT OF MANGANESE IN PARTS PER MILLION. THE LETTER S REFERS TO SURFACE SAMPLES, THE LETTER B TO BOTTOM SAMPLES

Date	Parts per million	Date	Parts per million
5/24/29	S. .044	9/21/29	S. .120
			B. .120
6/12/29	S. .106	9/27/29	S. .080
7/2/29	S. .055	10/5/29	S. .128
			B. .100
7/16/29	S. .075	10/12/29	S. .096
			B. .088
8/7/29	S. .114	10/19/29	S. .080
	B. .084		B. .072

The results shown in Table I were obtained from samples of filtered water, and they presumably represent the manganese that was in solution and not the total manganese.

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[1] Raber, "Principles of Plant Physiology," Macmillan, 1928.

[2] *Ann. Bot.*, 24: 571, 1910.

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