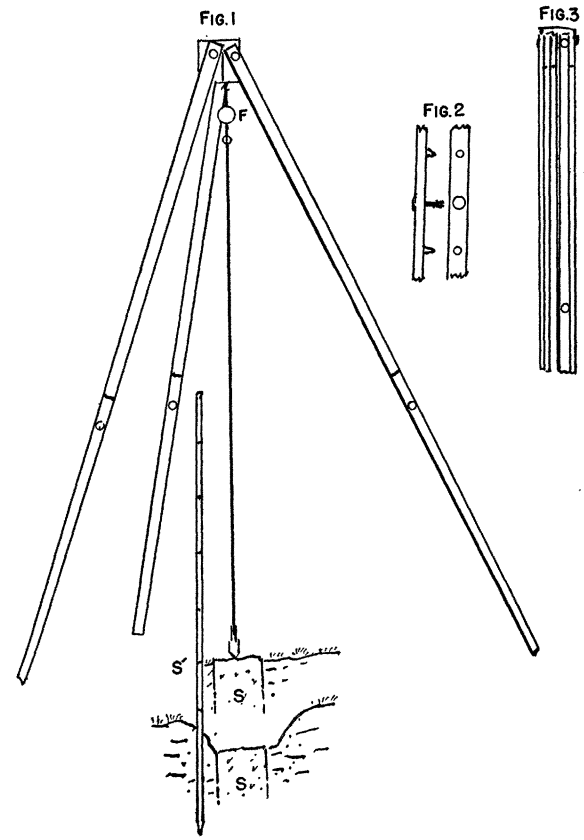
A LOW-PRICE STATION INDICATOR

IN surveying rather accurately limited private or company holdings one frequently feels the need of some device for use as a temporary target where ordinary ranging poles are quite unsatisfactory—unsatisfactory for two reasons: First, modern asphalt, paving and surfacing work in general as well as permanent rock, concrete or metal markers do not permit of driving in a sharpened flag-pole at the exact station center; and second, if off center, as shown by S′, Fig. 1, near a station S, visible or depressed below the reach of the plow, the transitman can make use of it in but one position, *viz.*, when he, station S and rod S′ are exactly in line, otherwise grave errors are introduced.

A long-legged, home-made tripod helps matters out greatly and saves more than its cost in a few hours' work.

Take a triangular prism 4 to 6 inches long and to each face bolt a slat $\frac{5}{8}$ in. thick, by 1 to $1\frac{1}{2}$ wide and seven or eight feet long, as indicated by Fig. 1. These slats may be jointed so as to fit tightly together and fold as indicated in Figs. 2 and 3. Nuts with wings should be selected. A screw hook and plummet are for objects self-explanatory. As the "bob" is too near the ground for convenience in sighting, a hollow rubber ball, F, may be slipped over the plumbline and will stay put at any desired elevation, the higher the better for observation and eliminating pendulous movements of the "bob."

The upper portion of this tripod when painted white is very conspicuous and easily picked up by the telescope, while the white plummet, or the rubber



sphere if painted white or red and white serve for refined sighting.

The cost of material and labor is $3.00.

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SPECIAL ARTICLES

LIGHT IN RELATION TO DORMANCY AND GERMINATION IN LETTUCE SEED

THE light-sensitivity of prepared photographic film is now so familiar as to be rated a commonplace; but that an exposure of a few seconds may mean the difference between no germination and complete germination in moist lettuce seed has only recently been appreciated through the studies here reported. Since "dormant" lettuce seed so exposed to light may be germinated in 24 hours in distilled water the material proves to be unusually well adapted to the study of light as a potential factor in "dormancy" and germination.[1]

The following results obtained with a 60-watt Mazda bulb as a source of light indicate some of the general characteristics of light in relation to the germination of "dormant" lettuce seed:

(1) ATTAINMENT OF MAXIMUM SENSITIVITY TO LIGHT

Variety: Big Boston
Culture medium: Water
Temperature: 25° C.
Illumination: 600 foot-candle minutes.

Time of soaking in minutes	Percentage germination
10	20.3
30	53.8
50	62.1
60	66.7
80	74.6
100	90.5

[1] In July, 1933, at a meeting of the Association of Official Seed Analysts of North America, A. L. Shuck presented a paper in which it was stated that the beneficial effect of presoaking "dormant" lettuce seed at low temperatures was largely due to light rather than to soaking.

(2) EFFECTIVENESS OF ILLUMINATION AT TIME OF MAXIMUM SENSITIVITY TO LIGHT

Variety: Arlington Fancy
Culture medium: Water
Temperature: 20° C.
Presoaking: 2 hours
Light exposure: 1 minute.

Foot-candle-minutes of illumination	Percentage germination
2	0
8	7
32	37
64	54
128	73
512	84
2048	86

(3) RELIABILITY OF THE TIME-INTENSITY PRODUCT IN ILLUMINATION

Variety: Arlington Fancy
Culture medium: Water
Temperature: 20° C.
Presoaking: 2 hours.

Illumination in foot-candles	Time of exposure in minutes	Percentage germination
64	1	53.5
32	2	52.8
16	4	54.5
8	8	58.1
4	16	47.5
2	32	58.2

The following results were obtained with sunlight:

Variety: Arlington Fancy
Culture medium: Moist paper
Temperature: 20° C.
Presoaking: 2 hours
Illumination: 1200 foot-candles

Time of exposure in seconds	Percentage germination
0	0
60	99
15	97.9
4	97.5

The above results suggested that sunlight was perhaps more effective than electric light in promoting germination and attention was directed to the quality of light. In carrying out further studies the longer wave-lengths of the visible spectrum, characterizing red, orange and yellow light, were found to be the ones effective in promoting germination. The shorter wave-lengths of the visible spectrum, characterizing violet, blue and green light, were found to be not only ineffective in promoting germination, but definitely effective in inhibiting germination.

The following results were obtained with filters, using a 60-watt Mazda bulb as a source of light and a Weston photronic cell for measuring illumination:

(1) QUALITY OF LIGHT IN RELATION TO GERMINATION

Variety: Arlington Fancy
Culture medium: Water
Temperature: 25° C.
Light: Continuous exposure at 3 foot-candles.

Wratten filter numbers	Color	Effect on germination
23, 24, 25, 26, 27, 29, 30, 31, 32, 33	Red	Promote equally well
15, 16, 21, 22, 23a	Orange	Promote equally well
3, 6, 7, 8, 9, 12	Yellow	Promote equally well
64, 67	Green	Promote equally well
44, 55, 56, 57, 57a, 58, 59, 59a, 60, 61	Green	No germination
38, 44a, 45, 46, 47, 48, 48a, 49, 50	Blue	No germination

(2) INHIBITORY EFFECT OF BLUE LIGHT ON GERMINATION

Variety: Arlington Fancy
Culture medium: Water
Temperature: 25° C.
Continuous light.

Foot-candles red light only	Percentage germination	Foot-candles red light +	Foot-candles blue light	Percentage germination
1	90.3	1	2.1	0
2	80.4	2	2.0	0
3	88.6	3	1.6	7.14
4	84.8	4	1.4	11.5
5	91.4	5	0.9	50.7
6	89.0	6	0.2	68.0

With the establishment of a definite light-sensitivity for so-called "dormant" lettuce seed, the question arose as to whether or not the "dormancy" could be broken by exposing moist seed to favorable wave-lengths of light independent of germination. A series of tests was carried out in which light-sensitive seed was soaked for two hours, exposed to a light for a sufficient time to insure germination, and then dried out. It was found that seeds so treated would germinate readily several weeks thereafter without light—in other words, the "dormancy" could be broken by a light treatment, after which the seeds would respond to the conventional methods designed for the germination of "non-dormant" seed. The possibility of making a practical adaptation of such a light treat-

ment to large lots of "dormant" seed is so obvious as to require no emphasis.

With the establishment of a definite inhibitory action for blue light it became of interest to try to induce light-sensitivity (in this case also a so-called "dormancy") in normal or non-light-sensitive lettuce seed by subjecting moistened seed to blue light for a time and then drying it out. A series of such tests was carried out in which it was found that normal or non-light-sensitive lettuce seed could be made light-sensitive by subjecting it when moist to a strong blue light. Seed so treated would not germinate in darkness, but would germinate under red light, or by suitable exposure to red light and drying could be again rendered normal or "non-dormant" or non-light-sensitive. The reaction involved in the above procedure is thus reversible, but no attempts have been made as yet to localize or identify the material or materials responsible for the action.

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THE PREVALENCE OF STREPTOCOCCUS BACTERIOPHAGE

THE subject of bacteriophage, the lytic principle which destroys bacteria, is of special interest to bacteriologists, but it is of general interest to all biologists. Hence this report is offered to SCIENCE.

The general interest in bacteriophage lies in the hope that a solution of the problems in regard to its nature may contribute something to an understanding of the great mystery of life. The study of bacteriophage promises to enlighten the philosophical consideration because it stands at the border line between catalytic chemical substances, on the one hand, and living matter, on the other.

If bacteriophage be regarded as an enzyme it must be conceded that it is endowed with at least one of the attributes of living matter—a limited ability for adaptation to its environment. On the other hand, the minute size of the individual particles offers an obstacle to the acceptance of the idea that they may be living organisms. It has been shown that they may be no larger than certain protein molecules. They are so small that ten or even a hundred billion individuals may exist in a cubic centimeter of broth which nevertheless remains as clear as crystal. In this communication no attempt is made to add weight to either side of the argument as to whether or not bacteriophage should be regarded as living matter, except in so far as new information on one particular aspect of bacteriophage may contribute to a general understanding of the subject.

Although it is known that bacteriophage specific for intestinal bacteria may be readily isolated from sewage, the belief is common that streptococcus bacteriophage is rare and difficult to obtain. In his recent review of the literature on bacteriophage Burnet[1] concludes that it is extremely rare to obtain a phage active against streptococci. He mentions the race which was isolated by Clark and Clark[2] as the only indubitable streptococcus phage on record. It will be referred to here as the "Wisconsin" phage.

The writer studied the streptococcus phage in commercial preparations and found that a second race has been distributed to various laboratories in this country, although it has been merely mentioned in the literature.[3] This second race was isolated in 1928 by Dr. Pearl Kendrick, of the Michigan Department of Health, from the feces in a case showing intestinal hemorrhages. It will be referred to as the "Michigan" phage.

A third race was isolated by the writer in April, 1933, from a sample of sewage received from Cincinnati. This race, designated as the "Cincinnati" phage, was recently reported briefly.[4]

The 3 phages were found to be useful in a study of the relationships of hemolytic streptococci. The collection on which this study is being made consists of over 300 strains from wide geographical sources and from all kinds of streptococcus infections of man and domestic animals. Some of the strains were found to be sensitive to one of the races of phage, some to another and some were sensitive to two or all three of them. In general, when several strains from a given epidemic were available, they were found to agree in their sensitivity to the 3 phages. Thus it became apparent that sensitivity or resistance to several races of phage offers a characteristic useful for the identification of hemolytic streptococci.

One rather large group of streptococci was characterized by failure to show sensitivity to any except the "Wisconsin" phage, which under certain conditions is capable of attacking about 97 per cent. of strains of human origin. It seemed desirable to find another race of phage which might attack the strains of this group, in order to give the group a more distinctive character. The readiness with which streptococcus phage was found in the samples of sewage examined is so contrary to its reported rarity that it seemed worth while to record the observations.

The group of streptococci for which a phage was

[1] F. M. Burnet, "Bacteriophage and Cognate Phenomena," in "A System of Bacteriology," Vol. 7, London, pp. 463–509, 1930.

[2] Paul F. Clark, and Alice Schiedt Clark, "A Bacteriophage Active against a Virulent Hemolytic Streptococcus," *Proc. Soc. Exp. Biol.*, 24: 635–639, 1927.

[3] Pearl Kendrick and Harriet C. Hollon, "Serologic and Bacteriophagic Relationships in a Group of Fecal Streptococci," *Jour. Bact.*, 21: 49–50, 1931.

[4] Alice C. Evans, "Streptococcus Bacteriophage and Its Usefulness for the Identification of Strains of Hemolytic Streptococci," *Ibid.*, 27: 49–50, 1934.