well from nearly all the higher forms of animal life, though the hemoglobin from the pigeon as a rule gives a somewhat more abundant growth. It is doubtful whether the hemoglobin is necessary on account of its nutritive properties, because extremely minute quantities in media suffice for growth. The phenomenon may be, therefore, a catalytic one; but further study along this line is needed to prove this point.

There are other points concerning these bacteria which need further investigation, for example, the phenomenon of symbiosis above referred to. In this regard many bacteria occurring in the lower animals should be studied and we should also study and record more thoroughly than has been done, the properties of the non-pathogenic bacteria in this respect.

This group of organisms it seems to me has not received as much attention as it deserves by bacteriologists in general. To illustrate this, I might call attention to the fact that in the very excellent and serviceable descriptive chart for bacteria prepared by the Committee on Methods of Identification of Bacterial Species and endorsed by the Society of American Bacteriologists no provision has been made for recording the properties which bacteria manifest toward blood. This not only applies to the group of hemophilic bacteria but also to many bacteria which have the property of hemolyzing blood and therefore commonly called hemolytic bacteria. Hemolysis is an important characteristic of certain bacteria, for example, streptococci, cholera vibrios, etc., and being fairly constant and quite readily determined by several methods it has come to be of real practical value in the identification and differentiation of organisms.

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SPECIAL ARTICLES

ARTIFICIAL DAYLIGHT FOR THE MICROSCOPE

AN examination of the laboratories for students, investigators and private workers with the microscope in our country will show that a very large number can not employ daylight, but must depend on artificial light, although increasingly in biology and pathology stains of all shades and combinations are used to color the objects studied to bring out their structural details.

As daylight is the form of light for which the human eye was developed in the course of its evolution, and as it is the only light which gives to the eye the true color values of the objects in nature, and the multitudes of artificially colored objects in the industries, arts and sciences, naturally many efforts have been made to render artificial light more like daylight.

The accompanying diagram shows very strikingly the difference between daylight and the light from a nitrogen-filled tungsten lamp. The lamp-light is *relatively* too strong in all the colors beyond the violet, and the difference becomes very great in the green and the red. In the other artificial lights commonly used, except the arc, the difference from sunlight is even greater.

As can be readily seen, in order to render any artificial light like daylight, the values of the various colors of the spectrum must be like those of daylight; and this can be attained only by reducing the excess of the red, green and other colors in the spectrum of the artificial light in such proportion as to make the energy curve of its spectrum like that of the sun.

Until very recently all the efforts to make a light filter or screen for artificial light which would transmit light having daylight qualities by which colors could be detected and discriminated with the same certainty as in daylight, were unsuccessful.

During the last two years Dr. Henry Phelps Gage, working in the laboratories of the Corning Glass-works, with the facilities there found, has developed a glass filter which renders the light from a nitrogen-filled tungsten lamp almost exactly like daylight.

In his own words:

> The investigation was started with the idea that a very close approximation to the theoretical requirements would be necessary, and the results have justified the belief that the most perfect approximations are the best.

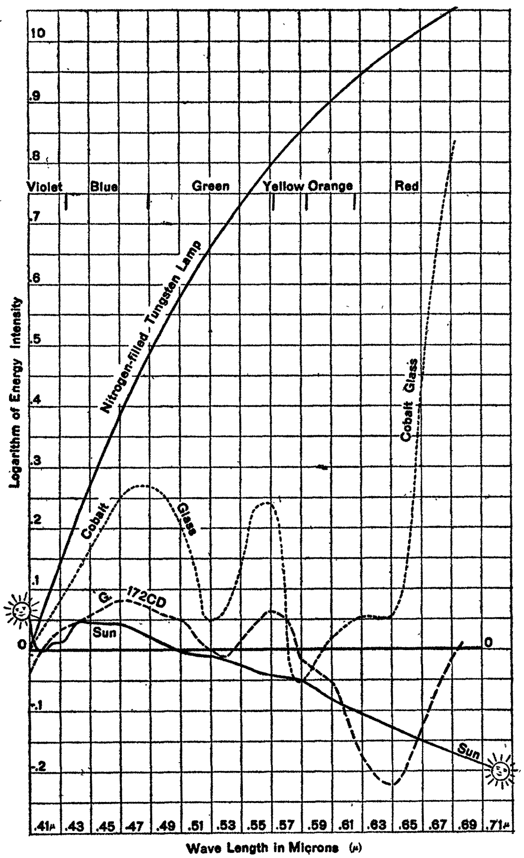

DIAGRAM SHOWING THE DISTRIBUTION OF ENERGY IN THE VISIBLE SPECTRUM OF SUNLIGHT AND OF THE LIGHT FROM A NITROGEN-FILLED TUNGSTEN LAMP; also of the lamp-light filtered through cobalt glass and through the daylight glass (G.172 CD).

The accompanying diagram shows the distribution of energy in the spectrum of sunlight and of the nitrogen-filled tungsten lamp; it also gives the curve of the light from the nitrogen-filled tungsten lamp filtered through cobalt glass and through the daylight glass, 172 CD.

The curve for the light filtered through the daylight glass approximates very closely to that for sunlight, especially between wave-lengths $.45\mu$ and $.65\mu$, that is, in the region of the visible spectrum giving the greatest amount of useful light.

While light filtered through the proper thickness of cobalt glass may look white to the eye, it gives even more imperfect color values than the unfiltered artificial light. This is intelligible from the violent irregularities of the curve of the light through cobalt glass, and especially the enormous excess in the red as shown in the diagram.

Light filtered through the daylight glass has been very critically tested in my laboratory with microscopic objects stained with many different dyes, and some of them with several dyes on the same specimen to differentiate the various structural details in the same organ. To make sure that the microscope modified in no way the color values, apochromatic objectives and compensation oculars were used as well as the achromatic objectives and Huygenian oculars.

The tests were made in the daytime by a window so that it was possible to turn the mirror from the artificial daylight to true daylight instantly and to determine any difference in appearance, if such difference existed. It was impossible to detect any difference in the colors, although tests were made with the most varied specimens and with a full range of objectives, including the 1.5 mm. oil immersion.

Not wholly trusting my own judgment, I secured that of colleagues in histology and embryology and microchemistry from our own and five other institutions, and their judgment entirely confirms my own.

In practise it was found desirable to have the daylight glass finished with the ground or velvet surface on one or both sides, and to place it in the opening of an opaque screen between the artificial light and the microscope. With this arrangement of the light, the effect is like that from a white cloud.

As stated above, this glass filter was designed to give daylight qualities to the light from a nitrogen-filled tungsten lamp, and gives the most perfect and satisfactory illumination for the microscope with this lamp. To thoroughly test the glass, the other light sources used in microscopic work were also tried; viz., the vacuum tungsten, and the carbon-filament lamps, illuminating gas with welsbach mantle, acetylene and finally the flat-wick kerosene flame. None of these other sources gave exactly the same color values as daylight. However, the approximation to daylight was surprisingly good, and the worst one, *i. e.*, the kerosene flame, gave better color values than the best artificial light without the color screen. The original intensity of the carbon-filament lamp and the kerosene flame is not great enough to give the best results with the daylight glass. This is because much of the artificial light must be absorbed to render it like daylight.

To the writer it seems that this glass must be a great boon to all those who must use the microscope with artificial light. As the light is soft like that from a white cloud, the comfort to the eye is most gratifying; and of almost equal importance, it gives certainty in distinguishing the most delicate colors and the various combinations of colors. It seems, furthermore, to promise great help in the textile and dye industries, in chemistry and in medicine, as it offers a standard daylight without the changes of real daylight depending on whether the sun is shining or whether the light is from the blue sky or from a cloudy sky. And finally it is believed from the experiences of the writer, that it will furnish great relief to those with sensitive eyes who must work by lamp-light, as it renders the light soft and agreeable like the most favorable daylight.

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A NEW ALFALFA LEAF-SPOT IN AMERICA

WHILE passing an alfalfa field in the vicinity of Manhattan, Kans., in October, 1914, the writer's attention was attracted by the irregular stand, which was noticeable from the road. Since light frosts were rather frequent at the time of year, the condition of the alfalfa was at first thought to be due to these, but closer examination indicated that these could not be the cause. Careful investigation showed that a leaf-spot was prevalent on many of the plants, and that it was strikingly different from anything with which the writer was familiar.

The plants affected were not producing a normal amount of foliage, the stems being sparsely set with spotted leaves, which were affected with a singular leaf-spot. The diseased plants thus presented an unthrifty appearance, and were also somewhat smaller than normal plants.

Since this was discovered on the last crop of the season, there was a question in the writer's mind whether it would be confined mainly to the latter part of the alfalfa season, or would make its appearance on the earlier crops. In the present season a close watch was kept on the first crop. The disease was again located in the aforementioned field on April 17, 1915, and further investigations have shown it in a number of fields belonging to the agricultural college. Furthermore, specimens have been collected in different localities within this state and other states. It has likewise appeared to a greater or less extent in the second and third crops in Kansas.

The material collected last fall was studied in the laboratory this winter, and cultural and inoculation experiments are now under way. There is no question as to its pathogenicity. The fungus is an ascomycete, the perfect stage (perithecia) being found in the mature spots. It belongs to the genus *Pleosphærulina*. The writer has been unable to locate any literature pertaining to its occurrence in America. The species has not been definitely determined. An alfalfa leaf-spot due to *Pleosphærulina Briosiana* Pollacci has been reported by Pollacci,[1] Bubak[2] and Puttmans,[3] in Italy, Austria and Brazil, respectively. There is some doubt, however, whether the species with which the writer is working is *Briosiana* Pollacci,

[1] "Spora una nuova malatta deil erba medica," *Atti del Instituto Botanico, dell' Universita di Pavia,* Nuova Serie, Vol. II., Serie 1901.

[2] "Eine neue Krankheit der Luzerne in Osterreich," Wiener Landwirtschaftliche Zeitung, Nov. 20, 1909, Nr. 93, s. 909.

[3] "Diseases of Cultivated Plants," *Revista Agricola Sao Paulo,* Nos. 114–125, pp. 379–381, 1905.