through evaporation and precipitation and by means of electricity or some more useful force.

By a general comprehension of the principles of nutrition, food will be more wholesome and more potent. The general acceptance of the principles of hygiene will make the average life of man longer and his usefulness more fruitful. Man will not only live longer, but he will be happier and practically free from the threats of enzymic, contagious and epidemic diseases. When this Society meets on that founders' day, the membership will be nearly 10,000 and its organization will reach to all quarters of our imperial country. The number of those who to-day are members and who shall live to 1976 is not large, possibly *nil*, but many who are infants to-day will be the revered old men on that centennial occasion. The orator who will address you on that day is perhaps not yet born. I hope he will take for his theme, the 'relation of chemical work to the advancement of mankind in the past century.' He will find in the development of some of the thoughts which I have tried to bring to your attention to-night the most potent causes that make for the good of man. In such a light as he can shed on life and its conditions the coming man will be able to see the true dignity of chemistry. H. W. Wiley.

U. S. Department of Agriculture.

DIAMOND-GLASS FLUORESCENCE.

Some five years ago I had occasion to cut a large number of photographic dry plates to smaller sizes. They were cut in the usual way—with a diamond and on the side of the plate opposite the film. In developing it was noticed that the film, to a breadth of a few millimeters along the edge of the plate, turned dark as if exposed to light.

Several possible explanations suggested themselves.

1. The breaking of the glass might produce momentary fluorescence and a fogging of the film near the break.

2. The breaking or tearing of the film might result in some sort of change in its character.

3. The scratching of the diamond might set up mechanical disturbances or vibrations in the glass and these might affect the film.

4. The friction between the diamond and the glass might cause a momentary fluorescence along the line traced by the diamond, and the radiation might penetrate the glass and fog the film on the other side.

The first and second suggested explanations were thrown aside at once, for the dark band in the film was found along the diamond scratch, whether the plate was broken or not.

That the third is not the true explanation was shown in several ways. The breadth and density of the dark band did not appear to depend upon the depth of the cut or the rapidity with which it was made. The line was always of about the same breadth on the same plate, but of different breadths on different plates. Moreover, the film always developed first on the side next the glass. The effect was noticeable on the most sensitive plates only.

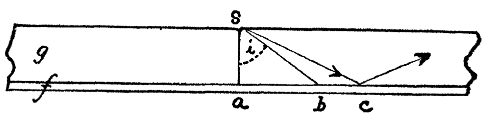

fig 1.

Let f represent the film on a section of the glass plate g, perpendicular to the diamond scratch s. Let s be a source of radiation.

All rays (as sc) outside the critical angle i are totally reflected and hence do not affect the film. Those having an incident angle smaller than i penetrate the film and fog it, if they are of sufficient intensity. The breadth of the fogged line is

$$b = 2\overline{a\,b} = 2\ t.\ \tan i$$

where t is the thickness of the glass plate and i is the critical angle for glass and the film substance. Using plates of different thicknesses, it was found that, in every instance, b varied as t to the degree of accuracy with which the measurements could be made. When a clear glass plate was laid on the dry plate, scratching the upper plate gave a band whose width varied as the combined thickness of both plates. If, however, the dry plate were turned over so as to have the film between the plates, the breadth of the band varied as the thickness of the upper plate. And in this case when the plate was placed in the developer, the band appeared first on the outer or upper side of the film.

It was found that fluorescence does not always occur when a diamond is drawn over a dry plate. Different diamonds and different brands of plates (glass) gave different results. To determine the cause of this apparent irregularity I made a series of observations, using ten different diamonds and nine kinds of plates. Seven of the diamonds were ordinary glass cutters, ranging in size from a very small stone in No. 1 (see table) to a large stone in plate glass cutter No. 7. Nos. 8, 9, and 10 were Brazilian black diamonds (in emery wheel cutters) known as carbonadoes. They appeared to be amorphous.

Ordinary plates, even the most sensitive, were not very sensitive to this fluorescence. Cramer, Stanley, Seed, Carbutt and Hammer plates were tried. Sometimes the diamond produced a slight fogging; usually it did not. In this respect no constant difference was noted in the different brands of plates.

To determine whether the quality or nature of glass influences fluorescence I asked the M. A. Seed Dry Plate Co. to supply me with plates of different kinds of glass coated with the same emulsion. The Company informed me that they were using four brands of glass, English, French, white crystal and American, and they sent me a supply of each kind coated with their most sensitive orthochromatic emulsion.

Their orthochromatic plate (No. 27) was found to be much more sensitive to diamond-glass fluorescence than the most sensitive ordinary plate. Fogging almost always occurred along the diamond trace, and the dark band was frequently very dense.

The following table embodies the results of the tests of different glass with different diamonds:

TABLE I.

Diamond.	Seed's orthochromatic plates, No. 27.				Seed's ordinary "Gilt Edge."	Total.
	English glass.	American.	French.	White Crystal.		
1. Small	trace 1	weak 2	trace 1	weak 2	absent 0	6
2. "	strong 4	absent 0	absent 0	weak 2	absent 0	6
3. "	strong 4	weak 2	trace 1	fairly strong 3	trace 1	11
4. Medium	strong 4	fairly strong 3	weak 2	fairly strong 3	weak 2	14
5. "	trace 1	trace 1	absent 0	weak 2	absent 0	4
6. "	trace 1	absent 0	absent 0	trace 1	absent 0	2
7. Large	trace 1	trace 1	absent 0	absent 0	absent 0	2
8. Carbonado	absent 0	absent 0	absent 0	absent 0	absent 0	0
9. "	absent 0	absent 0	absent 0	absent 0	absent 0	0
10. "	absent 0	absent 0	absent 0	absent 0	absent 0	0
Total	16	9	4	13	3	

Representing by numbers the relative intensities of the fogged bands, any total in the last column is obtained by adding the intensities for the five kinds of plates and a single diamond. Similarly the last row represents the intensities corresponding to all the diamonds and one kind of glass. The table shows that the fluorescence depends upon the kind of glass, and also upon the particular diamond used. One would expect the former, and one might not be surprised that the black amorphous diamonds do not act as do the clear crystalline stones. But that the latter differ among themselves is strange. It was thought that the difference might be due to differences in shape and the character of the scratch. This conclusion was rejected when it was found that diamond No. 4 would always fog the plate, even when the surface of the plate was not scratched at all. When the diamond was held out of cutting position and drawn across a plate, a dark band appeared on development. Diamonds Nos. 5 and 6 could scarcely be made to fog a plate, however they were held.

That friction has much to do with fluorescence was shown by the fact that sometimes a dark band would be discontinuous in two or three places along a diamond scratch.

The band produced by No. 4 was so strong that it was thought the fluorescent light might be visible. This proved to be true. When the eye was rendered very sensitive by being in absolute darkness for an hour, the conclusions drawn from the table were verified directly. The fluorescence from No. 4 was very marked, especially when English or white crystal glass was used. No visible fluorescence could be obtained with any of the black diamonds.

To test the equation $b=2t.\tan i$ a dry plate was laid on a table, film upward. A plate of clear glass was then laid on the dry plate and a diamond was drawn across the clear plate. The mean of several measurements of b and t gave a critical angle of about 39°. For the particular plate used, this was approximately the critical angle for yellow light, showing that, whatever other wave-lengths might be present the longest waves that affected the film were those of yellow light. This conclusion was strengthened by the fact that, to the eye, the light appeared to be a greenish yellow, and that orthochromatic plates were much more sensitive to it than ordinary plates.

Measurements of b and t for plates of various thicknesses gave values of i ranging from 38.6° to 40.4°. It would seem that the fogged band should be much broader when the dry plate itself is scratched, for then the critical angle is determined by the ratio of the indices of refraction of gelatine and glass. Measurements did not confirm this point, though they showed a constant ratio between b and t.

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*HOW BOTANY IS STUDIED AND TAUGHT IN JAPAN.**

MODERN botany was practically introduced into Japan twenty-four years ago by the late Professor Yatabe,† who studied botany at Cornell University, graduating in 1876. He became the first professor of botany at the Imperial University of Tokyo. Before him there were several botanists in Japan who studied the native plants quite thoroughly. But most of them being amateurs, did not know much about modern botany. Some of these old botanists still live. The well-known Dr. Keiské Ito, who was the Director of the Botanical Garden of the University before Professor Ya-

* A paper presented at one of the Botanical Seminaries, Cornell University, November, 1900.

† Professor Yatabe was drowned in the sea at Kamakura not far from Tokyo in August, 1899.