where ν is the wave-length of the active light, is then able to enter the silver ion, forming a neutral silver atom $Ag^+ + \theta = Ag$, while the unneutralized bromide ion loses an electron. $Br^- = Br + \theta$. This chain reaction, analogous to that suggested by Bodenstein for the action of light on $H_2 + Cl_2$, would go on to a limiting state, depending on the initial energy of the photoelectron, but producing a nucleus large enough to initiate development for a developer of given reduction potential.

A fuller account of the experimental work is to be published in collaboration with Mr. A. P. H. Trivelli.

S. E. SHEPPARD
E. P. WIGHTMAN
ROCHESTER, N. Y.

A METHOD OF ULTRAMICROSCOPY WHEREBY FLUORESCENCE IN THE CYANOPHYCEAE AND DIATOMACEAE MAY BE DEMONSTRATED

AT the recent meeting of the Royal Society of Canada I demonstrated the fluorescence of the Cyanophyceae. On returning to my laboratory I succeeded by the same means in finding that nearly all diatoms which I could find are also visibly fluorescent. In this regard the pigments involved stand in contrast to chlorophyll, inasmuch as the latter when in the living cell is not visibly fluorescent save when viewed spectroscopically, or by means of ultraviolet light. Raehlmann[1] believed, however, that he could detect it in suspensions by means of the ultramicroscope, but the fact was called in question by Czapek.[2] The reason of the non-visibility of the fluorescence of chlorophyll lies in the physical relation of this pigment to its carrier, so that the complex behaves optically like an emulsion or solid solution as, *e.g.*, chlorophyll in paraffin as J. Reinke[3] showed. It is, I think, possible to detect, by the optical means to be mentioned, slight evidences of the fluorescence of chlorophyll in the chloroplasts of *Spirogyra* and in some other plants, but they are not convincing. Not so, however, the phycocyanin of the blue-green algae and a certain red-fluorescent pigment in the diatoms. The following optical conditions enable one to observe this. They furnish indeed the most astonishingly striking and beautiful object pictures of these organisms one can imagine.

The necessary condition to achieve this result is that the organisms be viewed by means of brilliant reflected light derived from a dark field condenser. This can not be done if the glass slide is of the thickness called for by the current rules of the ultramicroscopy game, since then the light which falls on the object does so from beneath, and if the object be translucent, it passes through it towards the observer. If, however, a thin slide, one, that is, about 0.8 mm. thick or less, is used, one can raise the dark field condenser sufficiently high to cause the light cone to be reflected from the upper surface of the cover glass, provided, however, that a dry objective is used. The light now passes downward, so that the object is illuminated from above, and is seen by reflected light. When blue-green algae are thus viewed, the fluorescence of many kinds becomes readily visible. In some it can be seen only somewhat faintly, because of the numerous bright granules which furnish reflecting surfaces and so produce the effect of an emulsion. If, however, the organisms be mounted in glycerin the extraneous light is obviated, when the cells glow with a fervent light with its characteristic fluorescence color. *Rivularia, Cylindrospermum,* some species of *Oscillatoria,* rich blue-green by transmitted light (ordinary microscopy) and brilliantly outlined and accompanied by diffraction images when seen at the apex of the light cone, when seen at the apex of the inverted light cone become deep crimson. By meticulously focussing the condenser and objective at the same time, one obtains combinations of outline object pictures and fluorescence of rare beauty. Other species of *Oscillatoria,* some *Chroococcus* forms, and others have a yellower or golden sheen, while a species of *Nostoc* is bright orange. The cells of *Nostoc commune* obtained by crushing a gelatinous filament from some material (from China) given to me by Professor H. M. Richards about twenty years ago, glow deeply red, while the matrix appears a pale blue, perhaps because of adsorbed phycocyanin.

The visible fluorescence in the diatoms is confined to certain vacuoles which, by transmitted light, appear a pale greenish yellow, and which take up Sudan III. The pigment may be inferred to be oil soluble, and may be a chlorophyll, with the properties of chlorophyll alpha. It is not readily destroyed by heating, as is phycocyanin. Because of the numerous sources of reflection, the fluorescence can not be seen, or certainly can be seen only with difficulty, unless the material is mounted in glycerin. When thus viewed, the vacuoles, seen as blood-red, stand out in some species with great clearness. In *Navicula* there are two large vacuoles (as currently described) one on either side of the nucleus with its surrounding cytoplasm. Generally two smaller fluorescent vacuoles occupy the ends of the cell. In *Meridion* when small there may be but one large vacuole. In larger cells three smaller ones may occur. A circular colony of

[1] Raehlmann, E. Neue ultramikroskopische Untersuchungen über Eiweiss, etc. *Arch. ges. Physiologie,* 112: 128. 1906.

[2] Biochemie der Pflanzen. *1*: 564.

[3] Die optischen Eigenschaften der grünen gewebe, etc. *Ber. d. D. B. G.* 1: 395. 1883.

this organism with its green chloroplasts and intermingled red fluorescent vacuoles vies with a jewel set with emeralds and rubies for beauty.

Some of the *Pleurococcaceae* undoubtedly also are visibly fluorescent. I cite *Scenedesmus* and *Raphidium* (or it may be *Selenastrum*) as examples.

The best results are obtained with a cardioid dark field condenser, and when one is especially studying colors, an arc light. A 400-Watt condensed filament lamp serves well enough otherwise. Water instead of oil does between the slide and condenser, obviating messiness. I venture to believe that, when the above results are experienced, the use of the dark field condenser will be widely extended. Some of my own observations, accompanied by discussion thereupon, will appear in the forthcoming proceedings of the Royal Society of Canada.

The method of making use of the reflected hollow light cone derived from the dark field condenser has, I think, not consciously been taken advantage of. It very greatly enhances the value of this optical apparatus, as I have already found. The first sight of these fluorescent organisms invariably calls forth expressions of delight, and the experience recalls one's childhood days when the wonders of the microscope were real wonders.

FRANCIS E. LLOYD

McGILL UNIVERSITY

QUOTATIONS

RESEARCH AS A PROFESSION

TOWARDS the end of last February Sir Alfred Yarrow gave £100,000 to the Royal Soicety to mark his sense of the value of research to the community. He gave it to be used as capital or income, as the council of the society might think fit, because he recognized "that conditions alter so materially from time to time that, in order to secure the greatest possible benefit from such a fund, it must be administered with unfettered discretion." To emphasize this point Sir Alfred Yarrow suggested that any rules made for the administration of the fund should be reconsidered by the council every tenth year, so as to meet modern needs. While leaving the council this valuable discretion, he expressed his hope that the money would be used to aid scientific workers by adequate payment, and by the supply of apparatus or other facilities, rather than upon erecting costly buildings on which large sums of money are sometimes spent without adequate endowment, so that "the investigators are embarrassed by financial anxieties."

The council of the Royal Society has given attention to the best way of using Sir Alfred Yarrow's gift, and has this week published the result of its deliberations. The official announcement states that on reviewing the situation it appeared to the council "that there was a marked deficiency of positions in which a man who had already proved his capacity could continue to regard research as the main occupation of his life. Consequently at the council meeting of the fifth inst. it was finally decided to use the larger part of the income in the direct endowment of research by men who have already proved that they possess ability of the highest type for independent research. To this end a number of professorships will be founded, of type similar to the Foulerton professorships, which were founded by the society in 1922 for research in medicine. The professors will be expected to devote their whole time to scientific research, except that they may give a limited course of instruction in the subjects of their research to advanced students. There is at present a tendency to regard scientific research as a secondary occupation for men whose primary occupation is the teaching of students. The intention of the Royal Society in founding these professorships is to recognize research as a definite profession."

We make no doubt that the council of the Royal Society has rightly interpreted Sir Alfred Yarrow's wishes, and it will be observed that the two gifts which have recently been received by it—the Foulerton and Yarrow funds—have enabled it to establish a precedent new in this country at least, and not very common in any other. This new precedent is that research shall be the primary object of the incumbent of one of these professorships, and not, as has usually of necessity been the practice, an occupation secondary to the teaching of students. Sometimes, it is true, the occupant of a university chair has put research first and teaching second, but as it is his duty to teach, the university authorities may be disposed to grumble—not without some reason. No doubt the stimulus provided by a class of students is useful to some men, but, as Sir George Newman has more than once reminded us, the art of teaching requires special training and, perhaps even more, a special aptitude. A man may be an excellent teacher—many examples will come to mind—and not good at research work. The converse also is true. The two aptitudes do not always exist together, and there have been great scientific investigators who had no aptitude for teaching, except by example to a chosen few who assisted in the laboratory. The result of the great experiment the Royal Society is now able to conduct will not be known perhaps for a generation, but in its hands, and administered, as the donor desires, "by the best people from time to time available," there can be no doubt that the scheme must have a favorable influence on the progress of science in this country.—*The British Medical Journal.*