Urine of a young normal rabbit of the same weight (1,150 gm.) contained 0·1 mgm. per cent in an average daily volume of 200 c.c. The thyrotoxic rabbit, therefore, excreted about 100 per cent more urea daily than a normal rabbit of the same weight.

Assay of the thyrotrophic hormone content of samples of blood and urine from the thyrotoxic rabbit by injection into guinea pigs did not indicate presence of an abnormally high amount of thyrotrophin.

The basal metabolic rate of the thyrotoxic rabbit, as compared with that of normal controls of the same weight, and of untreated controls of the same age but double the weight (2,900 gm.) was quite distinctive. The carbon dioxide production in the thyrotoxic animal averaged 1·2 gm., as against 0·9 gm. in the weight control, and 0·8 gm. in the age control. This means an increased basal metabolic rate of 30 per cent compared with the weight control, and of 50 per cent compared with the age control.

An electrocardiogram of the exophthalmic rabbit had the following features: normal sinus rhythm; frequency 292; *P*-waves invisible in lead I and sharp and high in leads II and III; voltage high in lead I, especially high in leads II and III (1·1 and 1·2 MV. respectively); *T*-waves flat in lead I; normally positive in leads II and III. Summary: tachycardia, high *P*-waves, and high voltage, changes similar to those found in Graves' disease in man.

The exophthalmos, first noted four months after the implantation of the 10 mgm. œstrone pellet, persisted for four months, then gradually decreased, vanishing finally at a term which probably followed closely on the completion of the resorption of the implanted hormone depot. During this period, the basal metabolic rate of the formerly thyrotoxic rabbit reverted to normal (0·9 gm.) and before death even became subnormal (0·78 gm. carbon dioxide per hour per kgm. rabbit). The subnormal phase did not persist, however, for very long, since the animal died suddenly of emaciation a month after the disappearance of the exophthalmos, that is, five months after the appearance of exophthalmos, and nine months after implantation of the œstrone pellet, the animal at death being about a year old. Repeated ophthalmologic examinations of the fundus throughout the entire course of the experiment failed to reveal any pathological change.

The thyroid gland of the experimental animal exhibited no remarkable macroscopic or microscopic change. This finding was to be expected, since the animal died a month after the disappearance of the thyrotoxic symptoms, and after the basal metabolic rate had returned to normal values. The orbita showed no residue of exophthalmic œdema.

Creatin and creatinin assays of the urine carried out on the animal during the last months of its life yielded a puzzling result: only traces of creatin and creatinin were detected, whereas controls showed normal values of total creatinin (60 mgm. per cent) and traces of creatin. The absence of creatin(in) in the urine of the test animal in the post-thyrotoxic period may be explained possibly as the result of a retention of protein-building substance by the body for purposes of regeneration.

The œstrone pellet implanted into the peritoneum at the commencement of the experiment was sought at autopsy but had been entirely resorbed. This finding accorded well with the observed disappearance of all symptoms of thyrotrophic stimulation one month before the death of the rabbit. On the assumption that resorption of the 10 mgm. œstrone pellet was complete eight months after implantation, the rate of resorption was approximately 0·04 mgm. (= 400 I.U.) per day.

While it has been demonstrated in earlier experiments that protracted treatment with large doses of œstrogens blocks part of the functions of the pituitary anterior lobe, the above experiments show that it is possible also to stimulate the anterior lobe by œstrogens. Appropriate dosage and steady resorption of the œstrogenic hormone seem to be of importance for the induction of the stimulating effect. For this reason experiments designed to stimulate the pituitary gland do not succeed regularly.

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[1] Zondek, B., *Lancet*, **230**, 10, 776 and 842 (1936).
[2] Zondek, B., *Fol. Clin. Orient.*, **1**, 1 (1937).
[3] Deanesly, R., and Parkes, A. S., *Proc. Roy. Soc.*, B, **124**, 279 (1937).
[4] Zondek, B., *J. Exp. Med.*, **63**, 789 (1936).
[5] Zondek, B., "Clin. and Exp. Investigations on the Genital Functions and their Hormonal Regulation", 145 (Baltimore: Williams and Wilkins, 1941).

THE SCIENTIFIC OUTLOOK AND ITS PRESENTATION BY FILMS

By GEOFFREY BELL

THE new tools produced by men of science, particularly the instruments of mass communication, have placed the peoples of the world in a new environment. Characteristics of this are an immensely increased freedom of movement in space for every individual, and also an emphasis upon technology as a directive of social endeavour. We are having to adapt ourselves accordingly. Everyone now needs some knowledge of science, and a feeling for the scientific outlook if he is to live happily in this new environment. What means has the man of science to hand for presenting the scientific way of life so that it can become a habit of thought with the average person?

A quarter-century ago, Dr. Comandon, a biologist, wrote: "In our days, motion pictures are a necessity to the scholar who wishes to demonstrate to his colleagues transitory phenomena, delineate experiments or the general observation of things, beings or facts. . . . Some of these films, properly arranged, have proved useful for documentation, teaching and scientific propaganda."[1] These ideas have not been without fruit.

Before dealing with the broad problem, reference must be made to the use, mentioned here, of the film as a tool for scientific workers themselves. Science is no longer thought of as a regime of study and inquiry within watertight compartments of knowledge; it has come to realize that it must 'know itself'. At a meeting of the Association for Scientific Photography, Prof. Yule Bogue said: "Any particular branch of industry or science is largely dependent for its own advancement upon progress made in other branches. In order that the maximum benefits may accrue it is essential that knowledge of these advancements be disseminated as widely as possible."[2] It is the purpose of the Association for Scientific Photography to foster this use of the scientific film (as well as the still photograph), as pleaded by Dr. Comandon twenty-five years ago. The cinema of to-day is itself an interesting example of the integration of departments of science, bearing fruit through this kind of synthesis. Its lenses, lighting apparatus, thermionic valves, photo-electric cells, and the acoustic design of its film studios and cinemas, all have their genesis in different branches of physics; while its photographic emulsion is a product of chemistry.

To what extent is the film being used for 'scientific propaganda', the fostering of that integration of science with society, which the man of science should demand of this, one of his own creations ?

There is one direction of progress with which most people are familiar—the documentary and the instructional film. Documentary technique has been described as the "creative interpretation of reality". The more straightforward, less 'interpretive', treatment of reality produces the instructional or educational film. Part of the reality, which which the documentary film makers deal, is necessarily the relations between science and society. The film "Night Mail", for example, translated a technological achievement, the regular running of the Scottish night mail train, into an inspiring social document. "Song of Ceylon", an impressionistic documentary of life in Ceylon, had as part of its theme the impact of Western civilization (which includes technology) upon this Oriental culture. "Men of Africa", using a different, more factual technique, tells the same sort of story for part of Africa. These are three well-known documentary films. Yet none of them was set out primarily as 'scientific propaganda', though, in a large measure, that is what they are.

On another side the documentary film makers have courted science. Large commercial interests—notably gas and oil—were concerned with applied science, as well as sales promotion. They took the view that the best form of advertising was to inform the public about the techniques they used. Both interests made good expositional films dealing with aspects of their work, such as "How Gas is Made", "Oil from the Earth", "Lubrication of the Petrol Engine". They also made films with a wider emphasis, such as "Enough to Eat" (British Commercial Gas Association) and "Malaria" (Shell). Gas is used for cooking food, hence the interest of food problems to users of gas; oil is used for killing mosquito larvæ, hence the interest of malaria to oil users. Both films have a social value which soon becomes generally known—particularly if their approach is free from advertisement or bias, and has integrity. Hence their value from a public relations point of view. (It is worth noting, for example, that "Malaria", though made by an oil company, describes the use of Paris green as a means of killing mosquito larvæ alternative to the usual oil film.) The G.P.O. Film Unit (now Crown Film Unit) also produced such excellent expositional films as "How the Telephone Works", as well as the more 'human' documentary. Latterly, the chemical industry has produced a series of detailed instructional films on anæsthetics, and a long documentary—"The Harvest Shall Come"—which deals with the social and economic problems of the agricultural worker. The connexion of the chemical industry with medicine and agriculture is left to be assumed from the content, rather than explicitly stated in these films.

Such films are widely seen by audiences outside the public cinema. They are shown by clubs, institutes and film societies. Many are used in schools and technical colleges for direct teaching and for general educational purposes. The Services have been using them during the War. The War, in fact, has brought about an important development in this field; the Ministry of Information has become the central agency for Government film production. Besides films of general informative value, it has made films on civil defence, aspects of public health and of agriculture. They are available through the Central Film Library, which distributes them free to anybody wishing to show them. Most of them give the lay public a good elementary education in the applications of science with which they deal.

Besides these there is the 'popular science' type of film, best known of which is the Gaumont-British "Secrets of Nature" series. They were often produced in two versions—one for schools, and one with a 'popular' commentary for the cinemas. They were basically instructional films, pointing at scenes and facts rather than interpreting them in a wider setting.

All such films, particularly those obtainable from free libraries, were a potential source of supply for a new kind of audience—the scientific film society. In 1938 there were two of these—in London and Aberdeen. Then the War seemed to act as a stimulant. In 1941 there were six societies in Scotland[3], and in 1942 the Scientific Films Committee of the Association of Scientific Workers called a Scientific Films Conference, when it became clear that more societies would soon form. To-day there are in the British Isles some fifty scientific film societies. They are generally open to anyone who wishes to join, for an annual subscription of a few shillings; some half-dozen shows, of about two hours each, are given during the winter months, commonly at week-ends.

The interest of these societies is now brought to a focus by the Scientific Film Association[4], the present address of which is c/o Royal Photographic Society, 16 Princes Gate, London, S.W.7. The broad purpose of the Association is to develop the film medium in every way, to further the integration of science and society. It believes that the 'man in the street' must become the 'citizen-scientist'. The scientific film society which shows films to its members helps, in one way, to bring this about. For each such society forms an audience, at once appreciative and critical, which is a potential encouragement and guide to the makers of scientific films. Small and economically unimportant though it may seem, each such society is a growing point fostering the scientific outlook, and the Association encourages the formation of as many of them as possible.

The following things, among many, are needed: the development of a system of viewing, grading and appraising scientific films; a panel to advise film producers on scientific matters, and to check the accuracy of technical detail; technical assistance to scientific men and others working on scientific films; a free, central, scientific film library; and more scientific films in the public cinemas.

Most of these are long-term matters, though a beginning can be made now; a system of viewing and grading, for example, is being developed. But such things as the distribution of scientific films in public cinemas will take longer to achieve. This brings us to wider fields, outside the range of the physics and chemistry which produced the sound film. For the film has a unique power of conjuring into something very like reality a world which hitherto belonged only to the minds of men.

This has a special reference to the problem stated above—that social progress demands the integration of science and society. When this statement is made to the ordinary person, he has difficulty in even seeing its meaning. But in a film we can show him, let us say, a bare spot on a bacteria culture, where a Penicillium spore has fallen. We can show it to him through a microscope, and abstract ideas connected with it can be presented by a moving diagram; the scientific man's own deductions from this scene can be made 'real' by sound. The concept 'science' becomes something he can understand—in this case it may say "penicillin is bacteriostatic". The same film can also show wounded men being brought back from the coast of France and rejoining their families. The concept 'society' becomes also a real thing—ordinary people and their lives. The film can arrange its strips of celluloid so that the sounds and the pictures of these representations are linked together; science and society are shown to be integrated. The film brings to 'reality' something that is otherwise but a mind picture, inaccessible to many. Its audiences gradually become 'citizen-scientists' in the sense that they grow to appreciate that science is part of their lives.

But the film medium, like all scientific tools, is powerful for ill as well as good. It does not necessarily tell the truth—indeed there are certain fundamental difficulties in the way of its doing so. The viewing and appraising of films which deal with science is therefore an important task. The lives of such scientific workers as Pasteur, Ehrlich, Faraday and Curie have been put upon the screen, and in very different ways. Most recently, psycho-analysis has received the attentions of Hollywood. Some of these films are good in their effect; others are bad. Since the public will get much of its ideas of scientific workers and of scientific method from the cinema, it is vital that those ideas should be soundly inspired. It is more than a matter of physics and chemistry.

[1] From "The Film in National Life", published 1932 by the Commission on Educational and Cultural Films. The Commission was originally brought into being through the agencies of the British Institute of Adult Education and the Association of Scientific Workers. It resulted in the formation of the British Film Institute.

[2] See *Nature*, **151**, 718 (1943).

[3] *Documentary News Letter*, August 1942, article on "Scientific Films in Britain".

[4] *Nature*, **152**, 745 (1943).

THE MAXWELL LABORATORY AT THE UNIVERSITY OF MOSCOW

By PROF. V. ARKADIEV

THE Maxwell Laboratory of Electromagnetism in the Physics Department of the Moscow State University was inaugurated twenty-five years ago, and this anniversary has been commemorated recently.

The work carried on in this Laboratory has dealt mainly with Maxwell's electromagnetic theory of light, with the view of the further development of its fundamental principles: (1) light as an electromagnetic phenomenon; (2) the optical properties of bodies (such as lustre, transparency, refraction of rays, etc.) can be computed in advance according to their electrical and magnetic properties. The laboratory work has established further the identity of light with electromagnetic waves and the analogy existing between the two latter aspects of waves. In 1922 the Laboratory discovered a new source of radiation, the mass-radiator; this enables one to obtain intermediate ultra-Herzian waves, which form a connecting link between radio- and heat-waves. In 1934 special plates, sensitive to Herzian waves, were invented and prepared in the Laboratory; these plates have made possible the application in radio engineering of methods employed in photography (stictography), namely, those of fixing the traces left by radio waves upon paper.

Shortly before the War, the Laboratory demonstrated the possibility of using radio waves for radioscopy and suggested special screens, luminescent under the action of centimetre waves, similar to those used for X-rays. In the course of the further development of Maxwell's theory, the Laboratory has elaborated a comprehensive theory of 'passive' spectra, the most interesting result of this theory being the application of spectral analysis to the study of the magnetism of bodies; this involves the application of methods of mathematical analysis of optical absorption spectra to the investigation of the process of magnetization, particularly of the magnetization of technical magnetic materials.

The theory of passive spectra has been applied to the behaviour of matter of every description, beginning with the ionosphere and gases and ending with its coarser aspects, such as resin, cast iron, ores and rocks.

The combination of Maxwell's electromagnetic equations with the laws of motion established by Newton affords the possibility of obtaining general equations, representing a scheme of the behaviour of matter along the entire scale of electromagnetic waves. Among other things the scheme enables us to deduce the dispersion of Debye's dielectrics, the magnetic dispersion of paramagnetics and Compton's formula for the refraction coefficient for X-rays. An analogous inference is obtained for the magnetic properties of ferromagnetic bodies in the region of the ultra-Herzian waves, where the magnetic spectrum of ferromagnetic bodies is transferred into its own 'Röntgen' region in which, owing to the high frequency of the vibrations, only insignificant vestiges of the magnetic properties can remain.

AXIS ORIENTATION OF QUARTZ CRYSTALS

AN article by G. W. Willard (*Bell Lab. Rec.*, **22**, No. 7; March 1944) deals with the methods used in inspecting quartz crystals and in determining the axis orientation. In the original crystallization of quartz, foreign substances, such as other minerals or bubbles of gas or liquid, may be included, and part of the inspection procedure is undertaken to locate such inclusions so that they may be cut away. One of the dangers of using plates with inclusions is that the resulting discontinuities in their elastic and thermal properties may cause them to crack under the influence of temperature changes. Another common defect is the presence of cracks, due either to the effect of inclusions or to the rough treatment the quartz receives in river beds or in being broken from its natural formation. These cracks may be completely internal and very fine, and thus not