of Russian representatives as the first step to the organization of the Eighth International Congress, to take place, if possible, in 1947.

Conclusion

The Conference showed that, in spite of the War, decisive developments had occurred independently in the different countries represented. These developments were comprehensively summarized by Prof. Muller in his lecture, where he showed the primary importance of the concept of the gene in biology and more particularly in the application of physical and chemical methods to biology. It has, however, been on account of the War that a fuller use is now going to be made of this new genetics both in teaching and research in many different countries. A new epoch seems to be beginning in which biology will be treated as a whole.

DOCUMENTARY REPRODUCTION

By LUCIA MOHOLY

IT is becoming increasingly evident that documentary reproduction, the most popular group under the main heading mechanical aids to learning, is an invaluable help to men of science, educationists and other students. Among the various techniques available, preference has recently been given to microfilm as the quickest and cheapest method in all cases where one copy or a small number of copies are required. Another application of the micro-copying technique, the micro-card, is in preparation. It will be an addition, not an alternative, and does not affect the issues discussed here, since for the purpose of this article the relative merits of individual techniques are of secondary importance. However, we may expect to hear more of the micro-card in the near future.

It may be of interest to note that microfilm, after being invented more than seventy years ago, was completely forgotten, only to come into its own again when the need became imperative. In some countries, in particular the United States and Germany, microfilm was popular long before it became generally known in Great Britain. (One example may illustrate the extent to which it was used: before the War, 34 million cards in the U.S. Census Bureau, filed in 1,200 steel cabinets, occupying 7,000 sq. ft. of floor space, were microfilmed and thus reduced to occupy no more than 58 sq. ft.) Economy in storage space, bulk and weight, effected through microfilm, is now no longer unknown in Britain; nor are other purposes such as insurance against dangers of fire, water and enemy action. Precautions of this kind were taken everywhere and with great advantage during the War. Airgraph letters were one of the most outstanding examples of reduction in bulk and weight in air transport.

These obvious advantages, coupled with a few others of a less conspicuous kind, brought microfilm to the fore as a useful tool for purposes directly or indirectly connected with the war effort. Millions of documents were microfilmed in Britain and dispatched to distant places by air, and many millions of pages of varied literature, old and new, British and foreign, have been made available through the medium of microfilm to men of science and others all over the world. Large schemes have been sponsored by the

American Council of Learned Societies (manuscripts and early books in British repositories, for the United States), the Association of Special Libraries and Information Bureaux (foreign periodicals for Great Britain and the United States) and the British Council (British periodicals for China). Government departments, research institutions and scholarly bodies equally recognized the importance of the technique; and though some of the schemes are now coming to an end, the practical experience gained during the war years will be invaluable for the future. It must be assumed that emergency conditions will prevail for some considerable time and microfilm may be called upon to fill needs which cannot be satisfied by other means. But while hitherto most of the work was carried out by bilateral arrangement between the parties concerned, the type and extent of work awaiting attention in the future will require co-ordinated action and well-planned organization.

Going through the Directory of Microfilm Sources, published by the American Library Association in 1941 (apart from a few exceptions still reasonably up to date so far as English-speaking countries are concerned—a new edition is in preparation), we find that most of the existing units which supply microfilm or other photographic reproductions for purposes of study and research were attached to, or sponsored by, scientific and other institutions, libraries, bibliographical centres, colleges, laboratories, research stations, archives, record offices, etc.

Generally speaking, the activities of the existing units cover a small range of the potential tasks now open to modern reproduction techniques. Their services have mostly been limited to the supply of microfilm or paper copies of periodicals otherwise unobtainable, or of extracts from books and periodicals needed in connexion with special lines of research. Some of the institutions give their services to members only, others to non-members also. The majority supply extracts from books and periodicals in their own libraries; a few only have established exchange and co-operation with other libraries and institutions, locate references, compile bibliographies, or issue abstracting journals to facilitate selection of subject-matter of which copies may be required. Examples of the latter group are: ASLIB Microfilm Service (London); Royal Society of Medicine (London); Institut de Documentation (Paris); Army Medical Library (Washington).

Many of us look upon documentary reproduction as a modern substitute for hand transcription. This is correct—up to a point; and it was generally correct—until quite recently. With the advent of the micro-copying technique, the potentialities of documentary reproduction have increased to an extent which was entirely unexpected until a few years ago, and they are now in the course of materializing into new instruments ready to perform a great number of new tasks.

Preliminary Programme of Tasks

1. Issue of limited editions which may not justify the cost of type-setting; for example, dissertations, theses, private editions. The cost of a microfilm negative is comparatively low and can easily be covered by a slight increase on the cost of each positive. From an existing master negative, copies can be supplied individually upon request. There is no need for a minimum number of copies to justify investment, since the investment is negligible.

2. Publication of scientific papers which cannot be accommodated in existing periodicals. A brief note or an abstract would direct the reader's attention to the fact that a paper is available in microfilm form. Particulars of author, title, cost and address of supplier if other than the publisher of the periodical would enable readers to order their own copies.

3. Reports of laboratory and field work to be circulated among small numbers of subscribers.

4. Data sheets, figures, formulæ, etc., to amplify papers or summaries published in periodicals. Particulars including cost, and address of supplier if other than the publisher of the periodical, would enable readers to order their own copies.

5. Re-publication of out-of-print books for which the demand is too small to justify new editions. A provisional agreement on the microfilming of books was issued as a Joint Memorandum of Publishers and Authors in consultation with ASLIB, and published in *The Bookseller* of July 27, 1944.

6. Re-stocking of libraries damaged or destroyed by enemy action, depleted by purging and looting under enemy occupation; or suffering from the consequences of war-time and post-war restrictions such as shortage of paper, transport, staff, etc.

7. Inter-library loans. The supply of microfilms would eliminate waiting for books which are out on loan as well as the necessity of urging their return. The cost for the library would not be substantially higher. Some administrators claim that it would be lower.

8. Reproduction of card catalogues or sections of card catalogues, not likely to be published in print. This measure would enable different departments in a library to have their own copies of the main catalogue, and other libraries to acquire copies of important catalogues of which the originals are not readily accessible.

9. Saving of storage space in libraries and archives. This applies in particular to books and papers kept for record purposes and not normally required for reference. The proportion of shelving space needed for the originals as against space for storing microfilm is in some cases as high as 100:1.

10. Reduction in bulk and weight allows increased use of air transport.

11. Preservation of the contents of valuable manuscripts, early books, newspapers and other written or printed documents threatened with disintegration through age or other causes.

12. Protection from deterioration through frequent handling. The life-time of a valuable document can be appreciably extended if the original is made accessible in rare instances only. Students will often find it quite satisfactory to consult films in lieu of originals.

13. Facilities open to scholars in all parts of the world for studying unique documents without undertaking long-distance travel.

14. Safeguard against destruction by fire, water, etc. To render this safety measure effective, film copies must be stored in a place away from the originals. (All film used for documentary purposes should be non-inflammable safety film.)

15. Distribution of research material to serve men of science and letters, students and research workers. Adequately organized, all-round co-operation in this field can develop a new type of service by combining scientific, scholarly and linguistic qualifications with bibliographical research and documentary reproduction. This new type of service, if centrally co-ordinated, might be a step towards

the ultimate aim of keeping men of science and scholars currently informed of all the literature published on their respective subjects¹.

16. Analysis and reconstitution of existing publications, to provide dossiers of material relating to specific subjects. A great improvement on subject catalogues, press-cutting files and similar aids.

17. Supplements to bibliographical references not published with the paper or book, but available upon request. A note in a suitable place would direct the reader's attention to these supplements and give particulars, including cost and address of supplier if other than the publisher.

18. Educational activities and training schemes: (a) to relieve shortage of text-books and to supplement film strips; (b) as a help to children suffering from infantile paralysis (see item 20).

19. Re-education of children and adults in liberated countries. To relieve shortage of text-books and teaching staff and facilitate co-ordinated planning to direct and supervise educational activities.

20. Relief, rehabilitation and instruction for hospital patients, in particular war casualties and cases of infantile paralysis. Special apparatus for microfilm projection allows bedridden patients to read or study without help and at their own individual speed.

This list could be further extended, but must suffice for the present. Its main purpose is to demonstrate new categories of tasks and in particular direct attention to those which are bound to involve a number of interests from various quarters and can therefore only be planned and organized by co-ordinated effort.

Procedure and Users

Among the first and most important interests which should be invited to co-operate must be Government departments, libraries, bibliographical societies, information services, archives and records offices, library schools, learned institutions, scientific societies, research stations, educational authorities, universities, music academies, photographic societies, publishers of books and periodicals, authors, composers, abstractors, editors, and other professions. Their advice and assistance will be invaluable when programme and policy are being discussed, and contact with their opposite numbers in other countries will help to ascertain the extent to which co-operation can or must be international.

Not listed among the tasks awaiting attention, but equally important as a corollary to any large-scale planning is an accessory programme, including instruction courses (for personnel, librarians, students), information (to users and potential users), discussion meetings on questions of equipment, methods, economies (with colleagues, designers, manufacturers), and recommendations with the view of achieving world standards for machinery and material.

An important issue which will need renewed attention in the near future is the question of copyright. A provisional agreement has been reached on the microfilming of books²; and in so far as photographic reproduction is a substitute for hand transcription, it can be deemed covered by the amendment to the Copyright Act which grants fair use of copies needed for private study and research. If, as suggested, documentary reproduction is gradually transforming itself into a new instrument which can be put to a number of new uses, the copyright question will have to be reconsidered in a new light. In some

instances, royalties may be claimed and a modus will have to be found which is fair to all parties concerned. Obviously, the subject will need the co-operation of authors, publishers, learned societies and the legal profession in all countries³.

Another point on which there is much difference of opinion is the question of payment. The alternatives under discussion are: (1) free service; (2) annual subscription; (3) payment for the job. An authority on microfilm and related subjects, Dr. Atherton Seidell, secretary of the Executive Committee of the Friends of the Army Medical Library, Washington, D.C., wrote in *Special Libraries* (October 1944): "... the final complete acceptance of microfilm copying as a legitimate function of library operation is at hand. Since no part of library operation is ever conducted as a business enterprise, it is very unfortunate that microfilm copying should have been so considered. There is no more justification for charging for limited microfilm copying than there is for charging for any of the other services by which the resources of libraries are placed at the disposal of those capable of using them for the advancement of learning". The stress is on the "limited copying"—but it is exactly here where opinions—and practices—vary considerably. It would be helpful if general agreement could be reached on the question as soon as possible. With regard to the more extensive programme now awaiting attention, different categories of documentary reproduction will require different treatment from the costing point of view; but any such details of financial policy should be worked out in close co-operation between all the interests concerned and any decisions on these matters should be adopted by universal agreement.

There can be no doubt that developments in matters of documentary reproduction—in particular so far as planning and policy for the future are concerned—have reached a stage when nothing short of co-ordinated effort can produce practical results.

When documentary services were in their early stages, it was essential for those who recognized their growing importance to keep in touch and exchange experiences. The annual conferences and publications of the International Federation of Documentation (frequently referred to by the initials of its French title as F.I.D.) were great and important events. The last of these international conferences before the War took place in Zurich in the summer of 1939. (The first post-war conference is planned for the spring or summer, 1946.) Since then, documentary reproduction has made itself indispensable, and questions of practical organization have become pressing. Exchange of experiences through international conferences is more important than ever; but beyond this we need machinery for permanent co-operation in day-to-day matters, effective co-ordination of policy, and general agreement on a scheme of international planning in documentary reproduction.

It will take some hard thinking to work out a procedure which will make international co-operation in these fields practicable. As a first contribution to further discussion, the following is a tentative suggestion:

1. Permanent offices should be set up in each and every country to act as centres of organized national systems of co-operating institutions in the field of documentary reproduction.

2. Permanent co-operation should be maintained between national offices of different countries with the view of setting up an international system of repro-

duction services and co-operating institutions agreed on questions of policy, procedure and economy.

3. An international system of co-operating institutions in the field of documentary reproduction would be in line with similar systems in other fields already functioning, or outlined for consideration and discussion, such as an International Science Co-operation Service⁴; an International Information Council⁵; an International System of Library Loans⁶.

4. A permanent universal office should co-ordinate—under one central administration and guided by one agreed policy—the activities of all national and international centres, offices and systems of co-operating institutions in the field of documentary reproduction for purposes of study and research, science and learning, education and re-education in the post-war world.

¹ *Nature*, 155, 26 (1945); *J. Documentation*, 1, No. 1, 31 (1945).

² cf. Item 5, Preliminary Programme in Ref. 1.

³ *Photographic J.*, 85B, 92 (1945).

⁴ *Nature*, 154, 657 (1944); 156, 401 (1945); 156, 558 (1945).

⁵ *Daily Sketch* (February 12 and 15, 1945).

⁶ *The Times* (May 3, 1944).

THE SOLAR ECLIPSE OF 1945 AND RADIO WAVE PROPAGATION

By DR. R. L. SMITH-ROSE

National Physical Laboratory

IT has long been appreciated that an eclipse of the sun represents a unique opportunity of examining the effects of a temporary reduction or cessation of solar radiation on the ionosphere and the consequent effects on the propagation of radio waves. Observations of the influence of a solar eclipse on the reception of wireless signals have been made for more than thirty years past; and particular attention has been given to the use of radio wave-sounding technique to examine the changes brought about in the ionosphere by solar eclipses from 1927 onwards. The results of such previous investigations have shown quite definitely that ultra-violet radiation is the main cause of ionization of the lower layers of the ionosphere; but in the case of the upper region or F_1 layer, the results have usually been somewhat inconclusive. It has always been realized that swiftly moving neutral particles or corpuscles emitted by the sun could cause ionization in the upper regions of the atmosphere: because such particles travel much slower than light, there is an important difference in times of occurrence of what may be termed the 'optical eclipse' and 'particle eclipse' respectively. In consequence of the motions of the moon and the earth, the particle eclipse can occur from one to two hours in advance of the optical eclipse, the actual difference in time depending upon the velocity of the particles.

An additional series of measurements of the conditions affecting the transmission of radio waves through the ionosphere was carried out on the occasion of the solar eclipse of July 9, 1945, by the staff of the Radio Division of the National Physical Laboratory, working under the auspices of the Radio Research Board of the Department of Scientific and Industrial Research. These measurements were supplemented by a variety of other observations made by British Service establishments and other