I. V. Michurin: Selected Works. Foreign Languages Publishing House. Moscow, 1949. 496 pp. Collet's. 15*s*.

THE appearance of an English translation of the most important of Michurin's writings is timely in view of the widespread interest which has been aroused by recent developments in biology in the Soviet Union. A study of this work is essential for an understanding of the theoretical and practical trends in Soviet biology to-day. The reader must not however expect to find a series of neatly planned "critical" experiments leading to an equally neat series of theoretical conclusions. Throughout his working life, which extended over a period of sixty years, Michurin was concerned with intensely practical problems, with the production of new and improved varieties of fruit plants suitable for cultivation in central and northern Russia. In the course of his immense labours he carried out thousands of experiments and made tens of thousands of careful observations with this aim in view. From all this practical labour and experimentation he drew important theoretical conclusions which became fundamental to the development of his work. Michurin's theoretical ideas emerge quite clearly from his writings even though these are usually cast in the form of highly practical instructions or descriptions of his methods. He never lost sight of the importance of building up a correct theory with which to work, and like Darwin, he based his theories on the closest observation of nature, especially as revealed in practical agriculture.

The practical success of Michurin's methods is undoubted, and it is interesting to learn that the United States Department of Agriculture were so impressed that in the years 1911–13 they tried to induce Michurin to emigrate to America, or at least to sell all his varieties on favourable terms. These offers he turned down! Lenin recognised the importance of Michurin's work and with the establishment of the Soviet Government, which Michurin unhesitatingly welcomed, funds were made available to support his work. Laboratories were set up, and in 1931 the nurseries became the Michurin Central Genetics Laboratory, with Michurin as director and with a large staff.

The material in this volume is conveniently arranged according to theme, and within each thematic section the arrangement is chronological so that it is possible to follow the development of Michurin's ideas as practical experience steadily enriched them. The first, autobiographical, section is particularly valuable in this respect as it summarises the way in which Michurin advanced from the idealistic theory of acclimatisation of Grell, which proved a complete failure in practice, through the stage of mass selection, also unsuccessful, to his own distinctive methods of hybridisation and training of the hybrid seedlings, which were to prove so fruitful. The section on principles and methods provides a clear and absorbing account of Michurin's practice, together with the basis of his theoretical attitude to biology. Another section gives descriptions of a large number of Michurin fruit varieties and the processes by which they were produced. In both this and the preceding section there are numerous records of acute biological observations which, as will be mentioned later, have been extended and developed by Soviet biologists. Finally there are a number of miscellaneous articles by Michurin, some of great interest, including the very moving "Dream of My Life," written when he was eighty, in which he explains how socialism, and socialism alone, permitted the full flowering of the noble purpose to which he had devoted his life.

Michurin's writings are all characterised by their clarity and charm, and convey the unmistakable impression of a great and original personality. This impression is confirmed and deepened by the record of his life and work. As a youth he was fired with the idea of remedying the lamentable state of Russian horticulture, particularly in the central regions, and he deliberately set himself "two bold tasks: to augment the assortment of fruits and berries in the central regions by adding high-yield varieties of superior quality, and to extend the area of southern crop cultivation far to the north." The whole of his life was devoted to this selfless work, which was carried out under conditions of appalling difficulty for over forty years under Tsarism. Only his patriotism, self-discipline, and enormous industry enabled him to create more than 350 new varieties of fruit plants and to gather together one of the richest plant collections in the world. His attitude is revealingly expressed in his own simple words in a request to the Sixteenth Party Congress (in 1930) to pay attention to fruit growing: "We must break with the past and cease living for our own sake only—something that has unfortunately become too deeply rooted in each of us. We must all work for the good of all and the consequent general improvement in the standard of living will afford better conditions to every one of us. Throughout my life I firmly adhered to this idea and strove to the utmost to overcome all difficulties. I attempted to improve all that came my way: I have worked in various branches of mechanics and electrical engineering, perfected various instruments, studied agriculture. . . . But best of all I loved the work of improving cultivated fruit-plant varieties."

Owing to the impoverishment of his family—petty landowners whose mortgaged inheritance had to be sold—he had to renounce his intention of going to the university, and take a job on the local railway. For twelve years he worked on the railway, first as goods clerk and then as inspector of clocks and signals. In order to supplement his meagre pay he set up a watch-repairing business in his spare time, devoting his extra earnings to buying horticultural books and journals catalogues, and plants for

the small nursery which he was establishing. By this incredible industry he was finally able to make the nursery self-supporting and to give up his job on the railway. But his life continued to be one of poverty and privation, made harder by the attacks of religious obscurantists and the utter indifference and even hostility of the Tsarist ministry of agriculture. Only the coming of socialism relieved him of material worries and made possible a tremendous extension of his work and its application in the service of society. Michurin supported the Soviet Government from the first, and it shows the quality of his mind that he not only saw the vast possibilities of advance inherent in collective agriculture but that he linked the further development of his own work closely with the collective farms. This close relation between scientific investigation and practical agriculture has continued to be the source of strength of Soviet agronomy.

The most fundamental contribution to biological theory which Michurin makes is undoubtedly his treatment of adaptation. He recognised on the basis of his own practical results that the complex process of adaptation cannot be understood if it is separated from the process of development. As Prezent points out in an introductory essay to *Michurin's Collected Works* (Russian edition), this was the idealistic mistake of Lamark, which Grell repeated, namely, to consider adaptation as a process apart from development, outside the mutual influence of organism and environment. With Lamark the organism is transformed in order to develop afterwards, whereas with Michurin the organism only changes in the process of development. Michurin based himself on Darwin's conception of the organism which, developing and functioning only within the limits of the average conditions laid down by the historical past, conditions never absolutely repeated, is always being transformed, accumulating useful variations through a series of generations, by natural or artificial selection. The problem of adaptation was thus approached by Michurin in the sense of dialectical materialism as the unity of the organism and its environment. This dialectical approach was instinctive, although much later in life he consciously studied and accepted dialectics.

In order to adapt plants to new conditions, to change their hereditary constitution, the new environment must be allowed to act in the earliest stages of development, the embryonal and post-embryonal stages. Organisms are more plastic, that is, have greater adaptive possibilities, in the earliest stages. Hence Michurin's insistence that raising plants from seed is the best method of getting varieties adapted to their conditions of life. In particular he used hybrid seeds for training since such plants exhibit greater adaptability in consequence of their de-stabilised heredity. Many quotations could be given which summarise the methods he employed but a single one must suffice: ". . . The only correct method for solving the problem [of creating new varieties] is to raise

new local varieties for every district from seeds. Furthermore, in order to improve their quality, it is necessary to hybridise the old hardy local varieties with the best foreign ones. In the cases where there are no local varieties . . . the hardy parent should be selected from among the wildings that grow in countries with the most appropriate climatic conditions. When pairing the parent plants the most distant and least closely related varieties should be preferred because . . . hybrids are obtained that most easily and completely become adapted to the external conditions of a new locality."

Thus the basic principle of Michurin's operations was the changing of heredity by means of environmental changes acting on the early developmental stages of the organism. It is this conscious use of the adaptive capacity of plants in order to change them in a desired direction which is the new and distinguishing characteristic of his methods. Michurin makes it very clear that he was not a selectionist: he never denied the importance of mass selection in appropriate circumstances but considered that selection is not a sieve but a positive method of using the variability of organisms in order to transform them. Selection must be linked with the "shaken" heredity caused by hybridisation and with subsequent training of the seedlings. Thus Michurin worked with only some tens of seedlings at a time and he complains with reference to Burbank (whom he nevertheless greatly admired) that some writers had placed his own work "in an extremely false light by placing it on a par with the work of the late Burbank, an advocate of planting many thousands." Michurin's methods which he applied almost exclusively to fruit plants have been widely and successfully used in the Soviet Union in plant breeding. The work of Lysenko and his collaborators in transforming winter- into spring- and spring- into winter-cereals represents an extension of Michurin's methods and a striking confirmation of the correctness of his theoretical standpoint. Furthermore, the conception of heredity and of the organism-environment relation which Lysenko puts forward is quite obviously a clarification and deepening of conceptions which are already contained in Michurin. In this connection it is interesting to note the penetrating observations which Michurin made on the specific environmental requirements of plants. Such observations foreshadow a line of investigation to which Soviet biologists have paid considerable attention and which has culminated in Lysenko's phasal theory of development.

Just as the environment plays an active role in the transformation of plants by man, so Michurin considers that it plays a similar active role in natural evolution. Organisms are changed under the influence of environment, but only in the course of development, by the assimilation of new conditions through metabolism. The creation of new plants and animals in agriculture does not differ in principle from their creation in nature, except that the process is controlled and directed by man.

There are a number of references to Mendelism in Michurin's works from which it is obvious that he was not attracted by it. The reasons for this form one of the most interesting aspects of Michurin's thought. In the first place he found that the Mendelian laws of inheritance were of no assistance in the practical work of breeding. Even as a rule-of-thumb method of prediction they proved useless when dealing with fruit-plant hybrids, although it is interesting to note that Michurin recognises that the Mendelian laws may quite well apply for other plants in certain circumstances. But his criticism of Mendelism goes much deeper than this. In his view Mendelism is a purely formal analysis which neglects the specific biological nature of heredity.

Thus Mendelism appears to neglect or minimise the environment whilst Michurin found that environment had a marked effect on the type of inheritance, which depended on the age of the parents crossed, the treatment to which the seeds were subjected, the environmental conditions in which the young plants were reared, and so on. By varying the environmental conditions the character of the hybrid could be caused to deviate towards one or other of its parents. An even more serious weakness of Mendelism, in Michurin's opinion, is its failure to pay any attention to the history of the genotype. Michurin insists that great attention must be paid to the selection of pairs for crossing on a "historical" basis, since most influence is exerted by the older parent or the one with a longer history in particular conditions and therefore with the more stable heredity.

The correct selection of pairs for hybridisation is a problem which Mendelism cannot correctly solve. In questions of inheritance Michurin takes into account the degree of historically accumulated adaptability of the parents to definite conditions of development, the degree of hereditary influence of each parent in given conditions, and the enormous role of the environment in forming the nature of the young organism. In other words, he attempts to give a materialist biological analysis of the parental genotypes, not a formal Mendelian analysis, and to give a biological estimate of the conditions of training of the progeny. Thus Michurin's distant hybridisation is neither a piece of mystification nor a simple Mendelian combination: it is a profound biological process leading to de-stabilised heredity and an enrichment of the adaptive possibilities of the plant.

In this way Michurin began the materialist criticism of Mendelism which was developed and completed by Lysenko and other workers. He also contributed to this movement in another way by his numerous observations on stock-scion relations and the use of grafting not merely for propagation but as a means of influencing and improving immature fruit plants (by what he called the method of mentors). This method was used for example in the production of the Kandil-Kitaika apple, which is now a standard variety in the Soviet Union. Michurin brings forward

many examples of the way in which a plant can be altered by grafting provided it is in a sufficiently early phase of development. Such examples of vegetative hybridisation and its practical applications led to great interest in this subject. As a result Soviet biologists have carried out a considerable amount of work on the production and behaviour of vegetative hybrids. This work forms part of the growing body of evidence which has led to the abandonment of the Mendelian theory of heredity. In order to secure hybridisation Michurin employed a number of remarkable methods, the use of mixed pollen, vegetative approximation, repeated fertilisation, the use of an intermediary, etc., which lead to highly interesting and significant results. These methods have also been the starting-point for further investigations from which new views concerning the process of fertilisation have arisen, which cannot be discussed here.

It is impossible in a short review to do more than comment on a few aspects of Michurin's work. Perhaps enough has been said to indicate the relation between Michurin and later developments in Soviet biology and to show how the germ is to be found in Michurin. It is thus with justification that the new trends in biology have been given his name. A glance through the report of the famous 1948 session of the Lenin Academy of Agricultural Sciences shows the extent to which Michurinist techniques and theory now guide the practical work of Soviet agronomists. The study of this fascinating book will prove very helpful, and indeed indispensable, to all who wish to understand the nature of Soviet biological theory to-day and how it has developed. The book contains a wealth of practical advice for those who wish to practice Michurinist methods and it is to be hoped that those who can will try them out for themselves.

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THIS special number of the *Anglo-Soviet Journal* is devoted to the visit in November, 1949, of the Soviet Cultural delegation which came to Britain to mark the twenty-fifth anniversary of the foundation of the Society for Cultural Relations with the Soviet Union. It is an exceedingly important issue of that journal since it contains not only a most interesting account of the Delegation's visit to London and tour through the country but also verbatim reports of the addresses delivered by the delegates. Of these one may perhaps single out for special mention Professor Glushchenko on "The Fundamental Principles of Michurin Genetics" and Dmitri Kabalevsky's address on "Soviet Music."

The description of the tour makes it clear that the Russian visitors did much by their presence, their frankness, their humour and generosity of spirit to dispel the illusions prevalent about the life and work of Soviet intellectuals. Glushchenko made a considerable impression on the meetings of scientists, often assembled in a critical mood, to whom he spoke on Soviet biology. Kabalevsky won all hearts and reduced to pure fantasy the notion of Soviet composers as cowed and brow-beaten "artists in uniform."

Not the least valuable side of the Delegation's visit was the host of occasions for informal meetings with people especially interested in their own subjects. A series of admirable photographs afford vivid evidence of this.

The *Anglo-Soviet Journal* prints, in addition to the two papers mentioned, the lecture by Academician Volgin, the leader of the Delegation, on "Dialectical Materialism and Historical Science," a second historical paper by Dr. H. Matkovsky on "Historical Science in the U.S.S.R." and two papers on "Soviet Literature" and "Ukranian Soviet Literature" by Alexei Surkov and Pavlo Tychina.

To revert to Glushchenko, the special interest of his paper lies in the clear and formal enumeration of the eight most important principles of Lysenko and their subsequent exposition point by point. This is a most valuable and indispensable summary of which we were much in need.

Kabalevsky, in his paper on "Soviet Music," gives the clearest statement on the little understood term "formalism" that I have come across, and very clearly and usefully contrasts it with realism in music.

The Press, as the report points out, devoted little space to this important event. "On discovering that the Delegation were not surrounded by an iron curtain, the majority of the Press appeared to lose interest." This is an additional reason for ensuring the widest distribution of this issue of the *Anglo-Soviet Journal*, but all readers of *Modern Quarterly* will want to read this important collection of addresses and to have them in permanent form.

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