

# The Achievements of Marxism-Leninism In the Field of Genetics

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THE GENETICS CONTROVERSY which has raged in the Soviet Union for some twenty years is, in its immediate aspects, a conflict between two diametrically opposed theories of heredity. The scope of the controversy is, however, far broader than this. It extends to such fundamental questions as materialism versus idealism in the field of biology, the methodology of science, and the role of science in society. In fact, basically it involves a struggle between the bourgeois and Socialist outlook on scientific research.

## SOCIALIST SCIENCE VERSUS BOURGEOIS SCIENCE

In capitalist society, science is the handmaiden of the ruling class, for which it serves a two-fold function. On the one hand, it is an indispensable instrument for the development of new productive techniques as a means of increasing profits. On the other hand, the capitalist class looks to science to provide an ideological justification for its rule.

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Inevitably these two aspects of bourgeois science come into conflict. Technical progress is impossible without real science, without materialist theory which will stand the test of practice. But such theory, far from justifying capitalist exploitation, tends to expose its true character. Genuine science, rooted in practice, lays bare the lies to which capitalism must increasingly resort in order to perpetuate its rule, lies which can only be maintained through pseudo-science — through idealism and mysticism in science.

Hence, under capitalism the separation of theory and practice, of those who think and those who work, is unavoidable. "Under the capitalist mode of production it is, of course, undesirable that 'those who work with calloused hands' should think, because, if they began to think, they would understand that it was necessary to sweep away capitalist social relationships and create new, Socialist relationships."\*

As capitalism becomes more and

\* D. A. Kislovsky, in *The Situation in Biological Science*, p. 522.

more enmeshed in its internal contradictions, the gap between theory and practice of necessity grows. With the emergence of monopoly capital, technological improvements, always limited by the degree to which they offer prospects of immediate profits, become still further suppressed to protect the huge vested interests of the trusts. The talents of scientists and inventors become increasingly restricted to the development of new instruments of war and devastation. Simultaneously, as capitalism becomes ever more reactionary and fearful of progress, obscurantism, mysticism and persecution of the truth become more firmly entrenched in the theoretical field.

Nowhere is this more strikingly illustrated than in the field of atomic physics. Under capitalism the unleashing of atomic energy, an outstanding triumph of modern science, found its first "application" in the devastation of Hiroshima. Today, atomic research is confined to the development of still more frightful atom bombs, for which more money is being spent than the total outlay for scientific research in all of past history, while the development of the boundless potentialities of atomic energy for human welfare is completely stifled.

It is equally characteristic that while the achievements of modern physics are mustered with break-neck speed for the piling up of atomic weapons, the field of theoretical physics is loaded down with

the idealistic rubbish of logical positivism and similar philosophic doctrines whose anti-scientific character Lenin long ago exposed in his *Materialism and Empirio-Criticism*.

In general, theory becomes the property of scientists isolated from practice, who engage in an illusory search of "knowledge for the sake of knowledge." And although it becomes increasingly clear that what they are actually accumulating is knowledge for the sake of the imperialist bourgeoisie and its war program, this illusion of a "pure" science persists.

In the field of genetics, research is carried on in institutes and laboratories by geneticists who (to use Timiryazev's expression) work for themselves as "private gentlemen." The task which they set themselves is not the creation of new varieties of useful plants and animals, but only the abstract aim of discovering the "mechanism" of heredity. The practical tasks are left to the farmers and technicians, who go their own way independently of the "pure" scientists. The latter, in turn, look upon them with scorn. Men like Luther Burbank in this country and I. V. Michurin in Russia have created literally hundreds of important new plant varieties. Yet H. J. Muller, a leader of the campaign of vilification of Soviet science, characterizes them as men who have merely made a few lucky discoveries by trial-and-error methods, and who

have contributed nothing to biological science.

The entire approach of such scientists is inevitably a metaphysical, mechanical approach which isolates living things from their natural conditions of life, as they themselves are isolated from the world of practical production. At the same time, their own ideological adherence to the capitalist class leads them to develop the kind of sterile, idealist theory which that class requires.

In a Socialist society, on the other hand, science plays a totally different role. Here its aim is to serve the interests of the whole people, and not the mercenary interests of an exploiting class. Consequently there is no conflict between theory and practice, no separation of those who think from those who work. Scientists, technicians and the masses of workers and farmers are united in the common aim of constantly raising the level of production, of turning out an increasing abundance of goods for all to enjoy.

Soviet agricultural scientists therefore do not isolate themselves from and look down upon the masses of collective farmers and technical workers. In contrast to bourgeois geneticists like Muller, they hold with Michurin that "every collective farmer is an experimenter, and an experimenter is a transformer of nature." A scientist like Lysenko is not only a leading theoretician, but an outstanding organizer and leader

of thousands upon thousands of collective farmers.

Under Socialism, moreover, scientists are not fettered by an outworn profit system with its recurrent economic crises, unlike scientists in capitalist countries such as the United States, where an increase in the potato crop means only so many more million bushels of potatoes to be burned to get rid of the "surplus," or where an increase in the cotton crop means only so much more cotton to be stored in government warehouses to protect the profits of the big cotton planters, while millions go inadequately fed and clothed.

Nor are they compelled to prostitute their labors to the creation of more and more hideous weapons for human slaughter in the interests of a desperate ruling class. It is no accident that the first large-scale atomic explosion in the Soviet Union was not to test the destructiveness of an atom bomb, but was part of a vast project for the reclamation of huge areas of desert land.

Equally, it is no accident that in the U.S.S.R. there has developed a new, Socialist agricultural science and with it a new theory of heredity which challenges the very foundations of the classical genetics of bourgeois scientists. It is a theory which restores and develops further the revolutionary content of Darwinism, which bourgeois genetics had all but buried.

It is against this background that the genetics controversy must be un-

derstood, and that we may now proceed to examine the theoretical questions involved.

## DARWINISM

In the year 1859, Charles Darwin's memorable book, *The Origin of Species*, burst like a bombshell on the world of bourgeois science. The fruit of years of painstaking labor, this book not only revolutionized the field of biology, but profoundly affected all branches of natural science.

In it, Darwin first of all presented overwhelming and irrefutable proof of the fact that living things have undergone and continue to undergo a constant process of change and development, that the innumerable varieties of plants and animals on the face of the earth today are the descendants of a few, comparatively simple, original forms of life. True, the French biologist Jean Baptiste Lamarck had propounded the same idea at the turn of the nineteenth century. However, the enormous mass of evidence which Darwin was able to muster was not available to him and it was Darwin who first established the fact of organic evolution beyond any possible doubt.

Darwin's work shattered once and for all the theological dogma that living things had at some moment in the past been created in exactly their present forms, and the doctrine of fixity of species to which it gave rise. This dogma, which was an in-

tegral part of the prevalent metaphysical conception of a fixed, unchanging universe, had up to then completely dominated the thinking of biologists, and had long served the ruling classes as a powerful ideological instrument for defense of the *status quo*.

It is not surprising, therefore, that Darwin's theory aroused a storm of controversy and met with tremendous opposition. This opposition stemmed not only from the church, which attacked his ideas as destructive of all religion and morals, and accused him of seeking to degrade man to the level of the beasts, but from the ranks of the biologists themselves.

Such open opposition to Darwinism has by no means died out even today. Aside from the continued antagonism of certain religious groups, among them the Roman Catholic Church, there are in this country six Southern poll-tax states in which the teaching of Darwinism in public schools and colleges is to this day forbidden by law. We need only remember the disgraceful Scopes trial of the 1920's, in which a Tennessee school teacher was convicted of the "crime" of teaching evolution.

In this connection, it is an interesting commentary that the same American geneticists who are so ready to revile a Lysenko and to raise a hue and cry over an imagined lack of freedom of discussion in the Soviet Union, show virtually no con-

cern over this state of affairs in our own country. They are, of course, no different from those other spokesmen for American imperialism who constantly clamor about democracy in the far corners of the earth while they condone and foster the denial of the most elementary democratic rights here at home.

Marx and Engels, however, fully appreciated the revolutionary significance of Darwin's teaching. They recognized in Darwin's theory a discovery of enormous importance and a brilliant verification of the dialectical process in the world of nature. Engels stated, for example:

Nature is the test of dialectics, and it must be said for modern natural science that it has furnished extremely rich and daily increasing materials for this test, and has thus proved that in the last analysis nature's process is dialectical and not metaphysical, that it does not move in an eternally uniform and constantly repeated circle, but passes through a real history. Here prime mention should be made of Darwin, who dealt a severe blow to the metaphysical conception of nature by proving that the organic world of today, plants and animals and consequently man too, is all a product of a process of development that has been in progress for millions of years.\*

Darwin's contribution, however, does not by any means end with this. He also sought an explanation of how the process of evolution of living things is brought about. This he

found in his theory of natural selection, which may be briefly summarized as follows:

1. Living things are capable of producing vastly greater numbers of offspring than the environment can possibly accommodate. The result is a struggle for existence in which only a small fraction of the potential number of offspring succeed in surviving and growing to maturity.

2. Living things vary widely in structure and function, even within the same species. In fact, no two individual organisms are exactly alike. These variations are in large part hereditary; that is, they are passed on to succeeding generations.

3. In the struggle for existence, those variations which are best fitted to their surroundings have the advantage over the others and are selected for survival.

4. As the conditions of life (climate, food supply, etc.) change, new variations, better adapted to the new conditions, are selected by natural processes for survival. Thus new forms of life make their appearance, which may replace previous forms or exist alongside them.

In this theory Darwin offered for the first time a materialist explanation both of the remarkable fitness of living things to their surroundings and of the constant evolution of new forms of life. Previously the fitness of organisms had been explained in terms of the same dogma of a special creation by a divine

\* Frederick Engels. *Anti-Duebring*, quoted in *History of the C.P.S.U.*, p. 107.

Creator who, in his infinite wisdom, had simply made them that way. Even Lamarck, in his efforts to explain the process of evolution, had resorted to the idealist conception of an "inner desire" for progress, of a volitional, purposeful striving of living things to develop. The theory of natural selection, by providing a scientific answer to these questions, put an end to such idealist obscurantism and at the same time paved the way for tremendous advances in the practical task of creating new varieties of plants and animals useful to man.

This is the essence of Darwin's outstanding contribution to the science of biology. The basic correctness of his theories is attested to by the fact that since his day it has proved necessary to change relatively little in them. Nevertheless, his thinking was by no means free of bourgeois limitations, and his work consequently contains certain errors.

First of all, Darwin derived the inspiration for his theory of natural selection from the utterly false and reactionary ideas of the British economist Malthus. Man, said Malthus, multiplies in number far beyond the increase in the means of subsistence. From this there arises an unending, violent competition for existence, and therefore war, famine, pestilence and other scourges must of necessity intervene as a means of holding the size of the population down to the level permitted by the available supply of the necessities of

life.

It is not necessary here to analyze the obvious falsity of Malthus' apology for the dog-eat-dog ethics of capitalism. What is important is that Darwin uncritically accepted the idea of a biological struggle for existence in human society, and transferred the doctrine of a universal struggle for existence bodily to the entire realm of living things. This encouraged later apologists for capitalism to complete the question-begging circle by appealing to the theory of natural selection as a proof of the struggle for existence among human beings. Through this intellectual sleight-of-hand, they have sought to use Darwin's theory as a "scientific" justification of the most brutal exploitation of the working class and as a device for covering up the fact that the real struggle in capitalist society is the *class* struggle.

This is admirably expressed by Engels in the following words:

The whole Darwinian theory of the struggle for life is simply the transference from society to organic nature of Hobbes' theory of *bellum omnia contra omnes* [the war of all against all], and of the bourgeois economic theory of competition, as well as the Malthusian theory of population. When once this fact has been accomplished (the unconditional justification for which, especially as regards the Malthusian theory, is still very questionable), it is very easy to transfer these theories back again from natural history to the history of society, and altogether too naive to maintain that thereby these asser-

tions have been proved as eternal laws of society.\*

As a matter of fact, Darwin and his successors tended to overemphasize the role of the struggle for existence in natural selection. While overpopulation and competition undoubtedly exist in the organic world, natural selection and evolution may take place without their being involved at all, as Engels has pointed out:

Above all, this [the struggle for existence] must be strictly limited to the struggles resulting from plant and animal *over-population*, which do in fact occur at definite stages of plant and lower animal life. But one must keep sharply distinct from it the conditions in which species alter, old ones die out, and newly evolved ones take their place, without this *over-population*: e.g., on the migration of animals and plants into new regions where new conditions of soil, climate, etc., are responsible for the alteration. If *there* the individuals which become adapted survive and develop into new species by continually increasing adaptation, while the other more stable individuals die away and finally die out, and with them the imperfect intermediate stages, then this can and does proceed *without any Malthusianism*, and if the latter should occur at all it makes no change to the process, at most it can accelerate it.\*\*

Furthermore, some of Lysenko's results (such as the discovery that the rubber-bearing kok-saghyz plant grows better when planted in

bunches than when planted separately) have led him to question whether a struggle for existence among individuals of the same species occurs at all.

But despite those shortcomings, Darwin's teachings retain their essential validity and remain a scientific contribution of monumental proportions.

There is one vital question, however, with the investigation of which Darwin did not directly concern himself. That is the question of the causes of the hereditary variations upon which natural selection operates. Lamarck, in his law of use and disuse, had asserted that changes produced in an organism by the action of the environment are passed on to its offspring. Darwin himself similarly believed that heredity can be altered by direct action of the environment, but he made no effort to verify this belief experimentally.

It is in the search for the answer to this question that there have developed the two diametrically opposed schools of thought which have in recent years come into sharp, open conflict: on the one hand, the metaphysical, idealist approach of formal genetics, associated primarily with the names of Weismann, Mendel and Morgan, which became firmly entrenched among bourgeois biologists; on the other hand, the dialectical materialist approach developed by such scientists as Timiryazev, Michurin, Lysenko and their disciples in the Soviet Union.

\* F. Engels, *Dialectics of Nature*, p. 208.

\*\* *Ibid.*, p. 255.

## MENDELIAN GENETICS

The theory of heredity adhered to by present-day Mendelian geneticists is based originally on the speculative theories of the German biologist August Weismann.

According to Weismann, an organism consists of two distinct, independent parts, namely the reproductive cells or germ plasm, and the rest of the body or soma. It is the germ plasm, he asserted, which gives rise directly to both germ plasm and soma of the next generation, and which alone determines its hereditary features.

The germ plasm thus constitutes an unbroken succession from generation to generation, while the soma is merely a mortal by-product which serves as a vehicle and source of nutriment for the immortal germ plasm without in any way affecting its structure. Consequently, modifications of the soma acquired by the individual in the course of its development cannot be expected to have any effect on the appearance of its offspring, which is determined solely by the germ plasm. Thus Weismann concludes, in direct contrast to Lamarck and Darwin, that acquired characteristics are not inheritable.

The core of Weismann's theory is therefore the assertion that there exists a special, immortal hereditary substance which determines the course of development of the organism but which is itself completely insulated from and uninfluenced by

the living body of the organism and its conditions of life. Such a conception, in artificially isolating a portion of the organism from its surroundings, is clearly a metaphysical one. Moreover, the proposition that there exists a peculiar living substance which guides the interaction of the organism with its environment throughout its entire development, yet does not itself take part in that interaction and does not itself develop, is pure, undisguised idealism bordering on vitalism.

Pursuing his ideas further, Weismann declared that the hereditary substance in question is to be found in the chromosomes, minute, thread-like structures contained in the nuclei of the cells of which living things are composed. This proposition, which retains and merely refines the idealist core of Weismannism, is the essence of the chromosome theory of heredity accepted by formal geneticists today.

The basis of the present-day chromosome theory was laid by Gregor Mendel, an Austrian monk who conducted breeding experiments with different varieties of peas. Mendel's ideas were further developed and elaborated chiefly by the American geneticist Thomas Hunt Morgan and his followers, whose main object of experimentation has been the common fruit fly, *Drosophila*.

It is not necessary here to delve into all the complexities of the chromosome theory. Its main featu-



res, however, are the following:

1. The chromosomes contain sub-microscopic, self-propagating units, the genes, which are the determiners of heredity. The set of genes contained in the chromosomes of the germ cells determines the hereditary constitution of the individual which develops from them.

2. Hereditary variations arise from a) reshuffling and recombination of the genes through the process of sexual reproduction in which half the genes are contributed by the male parent and half by the female parent, b) rearrangements of genes, or changes in the structure or number of the chromosomes such that genes are either added or lost, and c) changes in the structure of the individual genes themselves, or mutations.

3. Mutations occur spontaneously in nature and can be produced artificially by exposing organisms to various forms of radiation or to other environmental agents. Artificially produced mutations are the same as those occurring in nature, the only effect of the artificial treatment being to increase the rate of their occurrence. Their direction is indefinite; that is, it cannot be predicted after a particular exposure in what direction the mutation will occur.

4. Modifications of the soma acquired during the course of development of the organism will not be inherited, since they do not change the structure of the genes or chromo-

somes.

It is clear from even this brief outline that the modern chromosome theory fully retains the idealist, metaphysical features of Weismannism, even though many of its adherents maintain that they are not Weismannists simply because they have rejected certain portions of Weismann's original theory. The chromosomes with their component genes constitute a self-perpetuating, immortal hereditary substance, independent of and unaffected by the rest of the body. Moreover, the genes are extremely stable (according to H. J. Muller, the average length of time between two successive mutations of a particular gene in nature is about 100,000 years), and are altered only by comparatively violent shocks which directly affect them.

In addition, the Mendelists introduce a further idealist concept, namely the indefiniteness and inherent unpredictability of hereditary changes, which flows from the principle of the independence of the hereditary substance from the rest of the organism. Thus I. I. Schmalhausen, an exponent in the U.S.S.R. of Mendelism, stated:

The external factor, on reaching the threshold of the organism's tissues, merely gives the first impetus which sets in motion the internal mechanism of a definite complex of form-building processes. It determines neither the quality nor the scale of the reaction. At best (and then not always) the external factor merely determines the

time and sometimes the place of the occurrence.\*

This idea is expressed in the following statement by the American geneticist L. H. Snyder:

The cause of these rearrangements of atoms—mutations—is probably inherent in the molecular structure of the genes. Mutations may be regarded as the results of random inter- and intramolecular motions. They are, in other words, the results of isolated microchemical accidents, not individually controllable.\*\*

This means that it is impossible in principle, by altering the conditions of life of an organism in a given direction, to change its heredity in a corresponding and predictable manner. The most that the plant or animal breeder can do is to hope for a lucky accident which will produce what he is seeking.

In practical breeding, consequently, the Mendelian theory limits our actions to the mere reshuffling of genes, to the selection of organisms possessing particular combinations of genes. Once we have obtained organisms possessing all the desired genes, we have a pure line which no amount of selection will change any further, unless a fortunate mutation should occur. The breeding of plants and animals is thereby confined to securing pure lines and perpetuating them endlessly.

Moreover, according to the Mendelian theory, mutations occur rarely and those that do occur are either imperceptible or, if more pronounced, are usually harmful. Therefore, while the heart of Darwinism is constant change, that of Mendelism-Morganism is virtual immutability. Instead of explaining the cause of the appearance of new hereditary variations on which Darwin's theory of evolution is based, Mendelism-Morganism restricts the possibility of such changes to such an extent as, for all practical purposes, to deny them. Although the followers of Weismann, Mendel and Morgan refer to themselves as Neo-Darwinians, their theory is in reality, as Lysenko maintains, a vulgarization of Darwinism. It is fundamentally anti-Darwinian.

In their application to human society, the unscientific principles of formal genetics inevitably lend themselves to the false, reactionary doctrines of inherent class, national, and racial superiority. They become a biological argument for the class stratification of capitalist society. The wealthy exploiters, we are told, have attained their positions as members of the ruling class because of their inherent biological superiority. The fact that families in the lower income groups have, on the average, a larger number of children than well-to-do families is constantly bemoaned as threatening the deterioration of the human stock. The solution for the growing problems

\* I. I. Schmalhausen, *Factors of Evolution*, quoted by M. B. Mitin in *The Situation in Biological Science*, p. 267.

\*\* L. H. Snyder, *The Principles of Heredity*, 2nd ed., p. 252.

of insecurity, poverty, crime, and war lies not in doing away with the system of exploitation, but in a program of eugenics allegedly designed to produce a "superior breed" of human beings.

In a like manner, the Mendelian conception of heredity serves those who peddle the lie of Anglo-Saxon superiority, and in this country it is used above all to bolster the vicious, corroding lie of "white supremacy" on which the brutal oppression of the Negro people is based. It is no accident that nowhere did Mendelism find stauncher admirers than in Nazi Germany, where it was widely proclaimed as the scientific basis for the bestial racist doctrines of fascism, which found their practical application in programs of wholesale sterilization and ultimately in the crematoria of Maidanek.

#### MICHURINISM: CREATIVE DARWINISM

The Great October Socialist Revolution in Russia brought about not only an unparalleled development of industrial production, but an even more profound transformation in the sphere of agriculture. The small individual peasant farms gave way to the huge collective and state farms which today account for virtually all of the agricultural output of the Soviet Union. The primitive techniques of Tsarist days were replaced by modern mechanized farming on the most advanced level. Furthermore, in a Socialist economy

agriculture was developed on a planned, rational basis, unlike capitalist agriculture where anarchic production, based only on the prospects of immediate profits, is the universal rule.

Obviously, under the new conditions of Socialist agriculture, the old agricultural science developed under capitalism could no longer suffice. A new science was required, a Marxist-Leninist-Stalinist science which would fulfill the needs of the Soviet people. Such a science has been elaborated, and it has played no small role in the astounding economic achievements of the Soviet Union.

To begin with, the manifold problems of agronomy were approached not piecemeal, not by scientists in different fields working on individual aspects of these problems in isolation from one another, but as an integral whole. Climate, soil structure, water supply, use of fertilizers, crop rotation, methods of tillage, improvement of crop plants and livestock—all were dealt with in their interrelationship, as parts of one single complex of factors. Scientists in all branches of agronomy coordinated their labors in accordance with one comprehensive overall plan, and at the same time worked in close collaboration with the millions of Soviet collective farmers.

Outstanding in the elaboration of this approach was the noted Soviet soil scientist V. R. Williams who, following the path charted by his

famous predecessor Dokuchayev, developed the *travopolye* system of agriculture, a system which envisioned both the transformation of vast areas to provide the best possible conditions for plant growth, and the perfecting of plant forms capable of utilizing the improved conditions to maximum advantage.

Through the planting of shelter belts, the construction of irrigation ditches and ponds, and similar measures, soil conditions were radically altered. The theory of diminishing fertility of soils, advanced by bourgeois scientists, was rejected. Instead, through scientific use of fertilizers, proper methods of crop rotation, and improved cultivation techniques employing new types of farm machinery, it was demonstrated that soils could actually be made to increase in fertility from year to year.

The practical application of Williams' principles has produced results which are truly spectacular, among them the remarkable transformation of large areas of semi-arid steppeland into fertile fields. Even more spectacular is the epochal Fifteen-Year Plan which has been launched since the end of the war, whose vast scope is indicated by the recent announcement of the use of atomic energy to level mountains for the purpose of reversing the direction of two large Siberian rivers and converting an area greater in size than France from arid desert to fertile, productive land. Through such

projects drought will be banished, the climate of large regions will be radically improved, and large, stable crops will be assured in the years to come. Such are the unprecedented goals toward which Soviet science is moving.

To the Soviet agrobiologists fell the task of creating new, more productive forms of useful plants and animals, forms able to take the fullest advantage of the best possible conditions of development. In pursuing this aim, they looked for theoretical guidance, not to the sterile Mendelian theory, but to the ideas of such men as K. A. Timiryazev and I. V. Michurin. They based themselves on Michurin's aphorism: "We cannot wait for favors from Nature; we must wrest them from her." Under the leadership of T. D. Lysenko, they have succeeded over a period of years in obtaining results not only of enormous practical value, but which challenge the very foundation of the chromosome theory of heredity.

These scientists approached the question of the relationship between the organism and its surroundings from a Marxist viewpoint. "The organism," says Lysenko, "and the conditions required for its life, constitute a unity."\* It is through the constant interaction of the two that life itself is maintained. If the external conditions are altered, the development of the organism will be altered as a consequence of the

\* *The Situation in Biological Sciences*, p. 35.

changed interaction, and this must apply to the *entire* organism. No portion of it can be set aside as being immune to changes in the conditions of life, as the Mendelists seek to do.

From such a materialist approach, it follows that the organism's heredity *can* be adaptively altered by changing the environment. A *materialist* theory of the evolution of living things, as Lysenko states, "is unthinkable without recognition of the inheritance of acquired characters." This is the heart of the Michurinist approach to heredity. Its correctness has been more than amply demonstrated in practice.

The Michurinists are able to point to innumerable experiments in which, by suitable modification of the environment, one plant type or animal breed has been transformed into another. By such means Lysenko has succeeded in transforming spring varieties of wheat into winter varieties even more frost-resistant than ordinary winter forms, and also in converting winter wheat to spring wheat. Similar transformations have been accomplished with other cereal grains. In a like manner, new and better varieties of flax, cotton, and many other plants have been obtained. Through proper control of feeding, exercise and other environmental conditions, there have been produced such varieties as the famous Kostroma breed of cattle, whose milk yield equals or surpasses that of the finest breeds throughout the

world, a new type of fine-wooled Askania sheep and a number of other new and superior breeds.

Even these achievements are overshadowed by the recent announcement of Lysenko, made on the occasion of Stalin's birthday, of the transformation of winter wheat into rye, a plant belonging to a different genus. This is an accomplishment whose possibility Mendelian genetics flatly denies.

Equally striking is the phenomenon of vegetative hybridization, in which certain features of one plant are transmitted to another through grafting. This cannot possibly be explained in terms of the chromosome theory, since there is no way in which any transmission of chromosomes between the graft and the host plant can possibly take place.

The Michurinist plant and animal breeders have also found that pure lines are not, as the Mendelists assert, uniform and unchangeable. On the contrary, selection within pure lines combined with suitable control of environmental conditions has become a widely used technique for securing new varieties.

These, as well as numerous other types of results secured by the Michurinists, directly contradict the Mendelian thesis of a special hereditary substance unaffected by the conditions of life. The Michurinist trend, therefore, is not founded on a few isolated and questionable experiments, but on a whole system of

connected facts gathered and verified by thousands of investigators over a considerable period of time.

These facts, moreover, have been tested not only in small-scale laboratory experiments. Their proof is to be seen in their practical application over millions of acres in all parts of the Soviet Union.

The labors of the Soviet scientists led by such men as Williams and Lysenko have immeasurably enriched Soviet agriculture, and have contributed greatly to the welfare of the entire Soviet people and, for that matter, of all peoples. Out of this wealth of practical attainment, there has emerged a new body of theory, the Michurinist theory of heredity, which correctly reflects man's ability to transform living things in a given direction and in accordance with his needs.

The main features of the Michurinist theory, as outlined by Lysenko,\* may be summarized as follows:

1. "Heredity is *the property of a living body to require definite conditions for its life and development and to respond in a definite way to various conditions.*" By knowing the requirements of an organism and the way it responds to external conditions, we can regulate these conditions so as to change its development, and thereby its heredity, in a given direction.

2. "The cause of changes in the nature of a living body is a change in

the type of assimilation, of the type of metabolism." That is, when the new conditions to which an organism is exposed are such as to compel a change in the character of its metabolism (the complex series of transformations of substances involved in the processes of life), then its requirements and responses—in other words, its heredity—become altered. On the other hand, superficial changes, such as mutilations, do not affect the organism's heredity.

3. Thus heredity "is inherent not only in the chromosomes but in every particle of the living body." Any portion of the body whose nature is altered by exposure to new conditions will, if it is the starting point of the next generation, produce offspring which are altered to one degree or another. In particular, the extent of hereditary transmission depends on the extent to which the nature of the reproductive cells, which are a product of the development of the whole organism, is changed.

4. As a rule, changes in heredity do not take place all at once. Rather, organisms with a plastic or "shaken" nature are produced. Such destabilization may be brought about by exposure to new external conditions, particularly in certain phases of development when one or another process is proceeding actively, by grafting, or by hybridization, especially of widely differing forms. The heredity of such destabilized organisms can then be directed along the

\* *Ibid.*, pp. 35ff.

desired paths by providing the appropriate conditions of development.

In contrast to Mendelism, which is basically anti-Darwinian, this Michurinist theory not only retains the heart of Darwin's theory but advances and enriches it. Darwin was content to *explain* the process of evolution. Dialectical materialism, however, is an instrument for *changing* nature and not merely explaining it. By utilizing this instrument, the Michurinists have mastered the problem of changing plants and animals, of creating new types according to plan, and hence of *controlling* the process of evolution. Michurinism therefore raises Darwinism to a new level, the level of *creative Darwinism*.

Michurinism also gives proper recognition to the important contributions of Lamarck, which were slighted by his contemporaries and later by the Mendelians. It was Lamarck who, among modern biologists, first formulated the theory of the evolution of living things, and who correctly, although in crude form, evaluated the role of the environment in the process of evolution. The Michurinists are not "neo-Lamarckians," as they are disdainfully termed by the Mendelists. Rather, while rejecting Lamarck's idealist interpretation of the response of organisms to changes in their environment, they have taken what is correct in the ideas of both Lamarck and Darwin and developed it to new levels.

## THE GENETICS CONTROVERSY

It was inevitable that sooner or later the Michurinists should come into open conflict with the adherents of formal genetics, who were firmly entrenched in leading positions in universities and institutes throughout the U.S.S.R., and who vigorously opposed the growing Michurinist trend. For a long time, the controversy was confined almost entirely to the Soviet Union with only occasional rumblings in other countries. Within the past few years, however, especially since the session of the Lenin Academy of Agricultural Sciences in the summer of 1948, it has broken out in full fury among scientists everywhere.

Formal geneticists in the U.S.S.R. themselves exposed their position as an untenable one by the very way in which they reacted to Lysenko's challenge. An objective scientist, confronted with an array of facts contradicting his theories, would at the very least check these facts and modify or discard his own ideas if they proved to be correct. This the Mendelists have not done. Not one single experiment has been offered by them to refute the Michurinists' claim.

Instead they sought to ignore them. The universities and academies did not teach Michurinism, and the textbooks, mainly translations of American texts, never mentioned it. As late as 1947, the Mendelist, Dubinin, found it pos-

sible to write an article on recent developments in genetics in the U.S.S.R., published in the American journal *Science*, without so much as mentioning the existence of the Michurinian school.

When they could no longer ignore them, the Mendelists flatly denied the validity of Lysenko's ideas, and ridiculed them as unscientific and absurd. They then reversed themselves and contended that Lysenko was unoriginal, that his discoveries were not new but had already been known for some time. And finally, they maintained that they agreed with Michurin, and that it was Lysenko who was not a Michurinist. But throughout all this, they clung doggedly to the basic concepts of Weismannism.

Even more vicious and unprincipled has been the assault on Soviet science by Mendelian geneticists in the United States and other capitalist countries, who have descended on Lysenko with all the fury and venom at their command, and who have made the genetics controversy the occasion for an unparalleled campaign of anti-Soviet vilification.

Leading the pack is the American geneticist Herman J. Muller. In a series of articles appearing in the *Saturday Review of Literature* in December of 1948, he opened fire with a barrage of gutter language and invective unworthy of any real scientist. He refers to Lysenko as "a charlatan," "an alleged 'geneticist'," a peasant-turned-plant-breeder." Ly-

senko's writings are characterized as "the merest drivel," and the Michurinist theory as "a group of superstitions that hark back to ancient times," and as "naive and archaic mysticism." Such language is clearly not that of an objective critic but of a man who has abandoned all reason.

Muller has since been joined by a host of other Mendelian geneticists. The entire June 1949 issue of the *Journal of Heredity* is given over to an attack on Lysenko by its editor, Robert S. Cook. The leading British biologist, Julian S. Huxley, has devoted an entire book (*Heredity, East and West*) to the subject.

Huxley's book is of particular interest, since he poses as a wholly unbiased, impartial observer basing himself solely on the facts of the case. However, his viewpoint is repeatedly disclosed as that of a bourgeois scientist to whom such things as a class approach to science are utterly incomprehensible, and whose professed impartiality and objectivity actually prove to be nothing more than petty-bourgeois "neutrality" in relation to the class struggle. It is not surprising, therefore, that his conclusions are identical with those of the more hysterical Muller.

In addition, run-of-the-mill book reviewers and professional anti-Soviet scribblers have blossomed forth in droves as "authorities" on Soviet science. These lackeys of American imperialism falsely assert that the Soviet technical literature contains vir-



tually no factual accounts of experiments on which other investigators can check, although accounts of Michurin's experimental work have been available for many years. At the same time, they level the insulting charge that Lysenko's experiments were conducted without adequate controls or precautions against accidental pollination or impure strains. Muller goes so far as to say of Lysenko that "he obviously fails to comprehend . . . what a controlled experiment is." A fitting answer to such gratuitous insults has been given, among others, by the Soviet Academician I. I. Prezent, who said:

Academician Zhukovsky interrupts and asks: was not the effect of vegetative hybridization actually due to unforeseen pollination by another variety; has there not been an unforeseen error here, a sexual hybrid having been obtained which has been called a vegetative hybrid? This is the usual argument and objection levelled against the Michurinists by the Morganists. I make so bold as to assure you that the Michurinists are far more experienced and subtle experimenters than the Morganists, and that the possibility of such an elementary error was of course foreseen and averted.\*

The Mendelists also accuse Lysenko of going to the ridiculous extreme of denying even the existence of chromosomes. This is absolutely untrue. The Michurinists do not deny the facts which have been accumulated regarding the chromo-

somes and their relationship to certain types of hereditary differences. Lysenko himself, speaking of vegetative hybrids, states:

Does this detract from the role of the chromosomes? Not in the least. Is heredity transmitted through the chromosomes? Of course it is.

We recognize the chromosomes. We do not deny their existence. But we do not recognize the chromosome *theory* of heredity. We do not recognize Mendelism-Morganism.\*

What the Michurinists reject, therefore, is not the body of valid facts which Mendelian geneticists have unearthed regarding the chromosomes, but only their contention that these facts justify their idealist theory of a special, independent, hereditary substance. What Lysenko denies is not that heredity is transmitted through the chromosomes, but that it is transmitted *only* through the chromosomes (or any other supposed special hereditary substance); not that mutations occur, but that this is the *only* way in which new hereditary varieties can arise.

In reality, the meaning of the established facts is completely distorted by their confinement within the straitjacket of an idealist chromosome theory, pretty much as the laws of dialectics were "stood on their head" by Hegel when he sought to fit them into an idealist world outlook. Only by removing the straitjacket and dealing with the facts from a materialist viewpoint

\* *Ibid.*, p. 584.

\* *Ibid.*, p. 609.

can they be correctly understood and applied. Whoever fails to grasp this misses the entire point of the controversy.

But the Mendelists steadfastly refuse to discard the straitjacket. The Mendelian theory has been seriously questioned by a number of American biologists in the past, among them the noted Negro biologist, Ernest E. Just. And in recent years an impressive number of experiments have been conducted in this country which demonstrated the heritability of acquired characters.\* The experimenters, moreover, are biologists of accepted standing even in the eyes of a Muller. They include, for example, such an individual as Dr. Tracy Sonneborn, president of the Genetics Society of America.

Despite the mounting evidence contrary to the Mendelian theory, however, the Mendelists cling tenaciously to their bankrupt dogma, and continue to insist that no demonstrated instance of the inheritance of an acquired character exists.

It is absolutely untrue, as Huxley and others claim, that what Lysenko attacks is the genetics of forty years ago, that geneticists no longer hold the views he ascribes to them. True, stubborn facts have compelled the Mendelists to modify their theory, but they have done so only to the extent of patching it up by tacking

on additional hypotheses. Its idealist core, however, remains intact.

Thus Muller himself states:

One of the fundamentals of the science of genetics is the demonstration of the existence in all forms of life of a specific genetic material, or material of heredity, which is separate from the other materials of the body. . . . The other materials, making up the body as we see it, have been developed as a result of the co-ordinated activity of the genes. . . . The genes themselves, however, are not changed in any directed or adaptive way by influences outside of themselves. . . . mutations occur as a result of ultramicroscopic accidents.\*

Huxley maintains that "Weismann's general conclusions about the inheritance of characters acquired by the soma still hold, although geneticists today formulate them somewhat differently. . . ."\*

In American textbooks, the Weismannist roots of Mendelism are often expressed even more bluntly. For example, one widely used textbook of biology, in a summary of the chapter on heredity, has this to say:

Germplasm is potentially immortal and is only protected and nourished by the somatoplasm. Environmental influences usually affect only the somatoplasm and do not reach the germplasm. Theoretically, then, acquired characters cannot be inherited.\*\*\*

\* H. J. Muller, "The Destruction of Science in the U.S.S.R." *Saturday Review of Literature*, December 12, 1948.

\*\* J. S. Huxley, *Heredity, East and West*, p. 15.

\*\*\* P. D. Strausbaugh and B. R. Weimer, *General Biology*, 2nd ed., 1947, p. 365.

\* For a review of some of these experiments, see B. Friedman, "Lysenko's Contribution to Biology," *Soviet Russia Today*, January 1949.

Similarly, Sturtevant and Beadle, two of Morgan's co-workers, in their textbook of genetics, state the following:

Weismann (1885-1887 and later) formulated the *germplasm* theory of heredity, laying emphasis on the germ line as the conservative element in heredity, the successive individuals being produced by it but not themselves modifying it. This concept, the forerunner of the distinction between phenotype and genotype, led Weismann to deny the inheritance of acquired characters, and also paved the way for the appreciation of Mendel's factorial hypotheses.\*

An almost endless series of similar quotations can be cited to show that Weismannism is as prevalent today as it was forty years ago, that *basically* Mendelism has not changed.

Among the most fantastic criticisms of Lysenko is Muller's allegation that the Michurinist theory is *vitalistic*, that the view that adaptive, directed modifications are inherited requires some sort of mysterious guiding or vital force. This is pure nonsense. Even Muller recognizes that adaptive modifications in organisms occur and that no "vital force" is required to explain them. Why, then, should it be required to explain the fact that such modifications may also affect the organism's heredity? Quite to the contrary, it is the Mendelian theory of a peculiar

living substance which is not affected by its surroundings that is idealistic and vitalistic.

Equally fantastic is Muller's assertion that Michurinism leads directly to the Nazi racist doctrine, since (he argues) it leads to the conclusion that a people which has been culturally backward would develop a hereditary inability to assimilate a higher level of culture. In the first place, such an attempt to transfer biological laws to the sphere of human society is entirely unwarranted and unscientific. Culture is a *social*, not a biological phenomenon, and is governed by *social*, not biological laws. Furthermore, as Muller himself would have to admit, were he not motivated by anti-Soviet bias, in the Soviet Union far more has been done in a short space of time to raise the cultural level of backward peoples than had ever before been dreamed possible. Secondly, it is no mere accident that it was Mendelism and not Michurinism which the Nazis glorified, for it is the Mendelian concept of fixed, inherent differences among human beings which especially lends itself to the claptrap of racism.

These baseless charges against Michurinism are being flung about in an atmosphere of the most intense anti-Soviet hysteria in the cold war on the biological front.

Once more we are treated to tales of those miraculous Soviet "liquidations" in which, years afterward, the "liquidated" individuals turn up

\* A. H. Sturtevant and G. W. Beadle, *An Introduction to Genetics*, 1939, p. 359.

very much alive and vocal. Once more we are told that no freedom of expression or scientific thought exists in the U.S.S.R. Muller gives voice to the outright lie that "from 1936 on, Soviet geneticists of all ranks have lived a life of terror . . ." and that "it has been a long time since the teaching of genetics was permitted in the U.S.S.R. . . ."\* This, in the face of the flood of publications by Soviet Mendelists which continues even to this day, and in the face of the fact that up to 1948 the teaching of Mendelism held almost exclusive sway in Soviet institutions of learning!

The truth is that this controversy was more open, more accessible to the public, and more widely participated in than any previous scientific debate in all of history. The intense interest of the Soviet public in the 1948 discussion is testified to by *Pravda's* devotion of over half its space for more than a week to verbatim accounts of the speeches.

In fact, it is this very interest on the part of the average Soviet citizen which the Mendelians most bitterly denounce. According to their ivory-tower viewpoint only scientists themselves are qualified or have any right to pass judgment on the merits of a scientific theory. They are particularly outraged at the idea of the Communist Party of the U.S.S.R. taking sides in a scientific controversy.

What these bourgeois geneticists fail to recognize is that in the Soviet Union science is the property of the whole people, who consider science to be in their service, and reserve the right to pass judgment on the contribution of scientists to the welfare of Soviet society. Certainly the Communist Party, as the vanguard organization of the people, has a vital interest in such matters, and so has the Soviet Government, since they involve the all-important question of how the nation's funds and energies shall best be utilized in the economic interests of the people. The genetics controversy is therefore not an academic discussion for the edification of a handful of the elite, but a matter of enormous practical importance to all Soviet citizens.

The charge that in the Soviet Union scientific questions are decided on the basis of political considerations comes with exceedingly bad grace from scientists who look on complacently when a teacher in this country is discharged for merely suggesting that Lysenko's ideas should be taken seriously, and who show comparatively little concern over the fact that, as Aragon puts it, "scientists desert the laboratories in order not to be suspected of treason."\* If there is any country where political considerations override scientific truth and where science is made to serve the reactionary interests of a decadent ruling class, it is the United

\* H. J. Muller, "The Destruction of Science in the U.S.S.R.," *Saturday Review of Literature*, December 4, 1948.

\* Louis Aragon, "Storm Over Lysenko," *Masses & Mainstream*, February, 1949.

States and not the Soviet Union.

Among those biologists outside the U.S.S.R. who hold a Marxist point of view, the reactions to the controversy have been varied, and even here a considerable amount of confusion exists. Such confusion stems in part from the fact that these biologists have been trained to accept the Mendelian theory without question and that little material on Lysenko's work has been readily accessible until very recently. Hence there has been a tendency on the part of some, while accepting Lysenko's findings as valid, to tread with extreme caution, and to come to the defense of Mendelism, which they felt was being unjustly challenged. Such a tendency, in fact, was characteristic of this writer's own initial reactions.

This confusion has led some Marxist biologists down the false trail of looking for a middle road, for a reconciliation of the two trends, a line which has been adapted by one section of the Soviet Mendelists. B. M. Zavodovsky, a leading representative of this group, proposes what he claims is a third alternative to both Mendelism and Michurinism. With the utmost impartiality, he attacks both trends "as being two distortions of Darwin's real theory."\* What he offers as "Darwin's real theory," however, turns out to be nothing more than a defense of Mendelism and an attempt to gloss over

the fundamental differences between it and the Michurinist theory.

Any such attempt is inevitably doomed to failure, for there can be no reconciliation between materialism and idealism. To compromise with idealism leads only to idealism. Zavodovsky's supposed third alternative is in reality nothing more than the illusory notion of the "third force," the stock in trade of the Social-Democratic lackeys of imperialism who use it to confuse and split the working class and who, while they pretend to fulminate with equal vehemence against both Communism and imperialist reaction, in practice faithfully carry out every wish of their imperialist masters.

Nevertheless, a number of leading scientists mistakenly, even though sincerely, advocate a so-called middle ground in the controversy. Outstanding among them is the eminent British biologist and Marxist J. B. S. Haldane.\* While Haldane recognizes the value of the contributions made by the Michurinists, he also argues that their attacks on Mendelism are largely unjustified and that the Mendelian geneticists are being attacked for views which they do not actually hold. His defense of Mendelian genetics, however, is based mainly on some rather serious misunderstandings.

Haldane regards Mendel's idealism as lying in his *formulation* of his

\* *The Situation in Biological Science*, p. 338.

\* J. B. S. Haldane, "In Defense of Genetics," *The Modern Quarterly*, Summer, 1949.

theory. "Mendel," he says, "used idealistic terminology." Here he is referring to Mendel's concept of unit characters, each transmitted by a particular gene or group of genes. Since geneticists have discarded this idea, he concludes that they have thereby discarded the idealist aspect of Mendel's theory.

But the point is that it is not merely Mendel's language which is idealistic, but the very theory of the existence of a special hereditary substance independent of the conditions of life of the organism. And this, as we have already shown, the Mendelists have by no means discarded.

Haldane argues further that Mendelists do not regard the genes or chromosomes as the only structures concerned in heredity. It is true, of course, that they maintain that other special hereditary substances exist besides the chromosomes. However, this in no way alters the idealist character of the Mendelian theory. What Lysenko contends (and what the Mendelists in general refuse to accept) is that the material basis of heredity is the *entire organism*, and that this is the only conceivable materialist approach to the question.

The same objection can be raised to Haldane's assertion that Mendelian geneticists do not believe in immutability, since they recognize the existence of mutation. But Lysenko, as we have already seen, does not deny that mutations occur. What he claims is that this is not the only way in which heredity can be changed, that

directed, adaptive changes in response to new environmental conditions can also occur. Haldane himself accepts the idea that acquired characters can be inherited, but it is not true, as he implies, that Mendelian geneticists on the whole accept it.

It is evident that Haldane's views differ in a number of important respects from those of most Mendelists. It is equally evident that he is defending genetics from attacks on grounds that are non-existent. He does so because he does not see clearly just where the idealism in the Mendelian theory lies and consequently does not fully understand in what respects it is incompatible with the materialist Michurin theory.

A similar confusion is exhibited by Bernhard J. Stern in this country. Stern maintains that Lysenko's "critical analysis of genetic theory represents an attack on positions long since abandoned by the vanguard of geneticists" and that "the gap between Lysenko and [present-day] geneticists does not appear to be absolute."<sup>\*</sup> He presents numerous quotations intended to show that Mendelists today disagree with Weismann, and that what Lysenko is criticizing is in reality only oversimplified or outdated views expressed in certain American textbooks. The "vanguard of geneticists," Stern contends, does recognize the role of environment and the existence of inheritance controlled by factors

<sup>\*</sup> Bernhard J. Stern, "Genetics Teaching and Lysenko," *Science & Society*, Spring 1949, p. 149.

other than the chromosomes.

But the very quotations he offers only serve to show that the differences between modern Mendelian genetics and that of forty years ago, though considerable, are not basic. The inescapable fact is that, even though they reject the crudities of Weismann's original theories, not only the authors of textbooks but *leading Mendelists themselves* fully accept Weismann's *basic* thesis of a separate, independent hereditary substance. They hold the same idealist view which Weismann advanced, and on this point the gap between them and Lysenko is absolute and irreconcilable. It is exactly this that Stern fails to see. By attempting to "bridge" the gap, he contributes to disarming us in the struggle against bourgeois ideas in the sphere of biology.

### SOME CONCLUSIONS

The genetics controversy has brought into sharp focus the fact that no phase of human activity is isolated from the social order in which it takes place. In capitalist society, bourgeois ideology penetrates into every field, no matter how remote from the class struggle it may seem to be.

It is the methodology and content

of bourgeois science which the Soviet formal geneticists have sought to perpetuate and against which the Michurinists under the leadership of Lysenko have been compelled to take up arms.

Our vigilance in the fight against bourgeois ideology on *every* front can never be relaxed. It is a struggle in which, on the biological front as on every other, there can be no compromise or reconciliation between the interests of the capitalist class and those of the working class.

In relation to the genetics controversy, Marxists generally and Marxist biologists particularly have a special responsibility—the responsibility of studying and mastering the theoretical questions involved and of waging a relentless, uncompromising fight for a Marxist-Leninist, materialist approach to the science of heredity.

There is no doubt that in the end Michurinism, as the true science of heredity, will win out. It will do so, however, not automatically, not because the supposed classless objectivity of scientists will lead them to accept it, but only through struggle. In the long run, it will emerge victorious only as the working class emerges victorious in its struggle to abolish capitalism and achieve a Socialist society.