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Diane B. Paul Marxism, Darwinism, & The Theory Of Two Sciences

In 1965 Louis Althusser looked back upon the role of French Communist intellectuals in the early days of the Cold War. With the Lysenko era clearly in mind, he wrote:

> In our philosophical memory it remains the period of intellectuals in arms, hunting out error from all its hiding-places; of the philosophers we were, without writings of our own, but making politics out of all writing, and slicing up the world with a single blade, arts, literature, philosophies, science with the pitiless demarcation of class—the period summed up in caricature by a single phrase, a banner flapping in the void: "bourgeois science, proletarian science."[1]

Today, even the most orthodox Marxists agree that the theory of two sciences, "bourgeois" and "proletarian," which received its fullest development under Stalin and its most ruthless—but not its only—application in the field of biology, indeed caricatured Marxism. But this caricature marked not just Soviet Marxists but many Communist intellectuals in Western Europe who, unlike their Soviet counterparts, had no need to fear that their views on heredity would endanger either their livelihoods or their lives.[2] This period of "forced conviction" in Western Europe as well as the U.S.S.R. revealed that the Marxist defense of Lysenkoism had a certain immediate plausibility.

As Louis Aragon wrote, in the dispute between the followers of "Mendelism-Morganism" and "Michurinism-Lysenkoism,"

> A philistine may be allowed to observe that the first decrees man's inability to change the course of species, to direct living nature, while the second claims to justify man's power to change the course of species, to direct the course of species, to direct heredity. He may be allowed to say to himself that someone who does not lay claim to dialectical materialism, to Marxism, will be less embarrassed if he chooses the first theory than a Marxist who, on every occasion, not just in biology, regards it as his role not merely to explain the world but also to change it. A non-Marxist is certainly more comfortable with the first theory than a Marxist. Or, to make myself more plain, if Marxism is postulated first, before going on to biology, the Marxist biologist will certainly be prejudiced in favour of the Michurinist theory which justifies the possibility of human action on living nature.[3]

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Aragon was expressing the sense of many French Communists that Lysenko views were more "dialectical" and more "materialist" than those of Weismann, Mendel, and Morgan. Even more striking is the condemnation Mendelian genetics by English Marxists. The "modern synthesis" of Mendelism and classical Darwinism was largely an English creation; J.B.S Haldane, one of its leading theorists, was also a deeply committed Marxi and author of numerous works, scholarly and popular, that propounded a dialectical materialist approach to the understanding of nature. Haldane himself quietly left the Party over this issue about 1949. But most Marxists including some distinguished biologists, adopted the Party line which dismissed Mendelian genetics—and hence the modern synthesis—as "bourgeois." After 1948 orthodox Marxist journals such as the *Labour Monthly* and the *Modern Quarterly* featured such statements as:

> The effects of the gene may interact with the effects produced by environmen change, but the gene itself is an unalterable and stationary rock in a raging sea change and motion. The Michurinists say that they cannot believe in such a situation; it is, they say, an undialectical conception quite out of accord with all knowledge of nature. Now that it is pointed out to us, it is difficult to disagre

These authors equate Marxism with "dialectical materialism"—i.e., wit general laws of natural and social development independent of human determination (the "ontological" version of dialectics). With this version Marxism it takes but a short step, as Dominique Lecourt has recently argued to dismiss bourgeois science as "undialectical" and "idealist" and to proje an essentially different proletarian science.[5]

The demand that nature be dialectical and materialist has, however, coexisted with the claim, expressed by Lenin and Trotsky among others, tha class bias interferes minimally with the natural sciences—a substantially objective form of knowledge. Ultimately, these two aspects of the orthodo Marxist view of science proved incompatible. From the 1930s until the mid-1960s a theory of two sciences asserted an official line which dismisse the "Menshevizing," "idealist," "undialectical"—in a word, "bourgeois"—theory of the gene.

Doubtless, Jacques Monod had this attack, pursued with exceptional ferv by the French Communist Party, in mind when, in *Chance and Necessity*, h insisted upon the incompatibility of Marxism and modern genetics: "Lysenk

was perfectly right: the theory of the gene as the hereditary determinant, invariant from generation to generation and even through hybridizations, is indeed completely irreconcilable with dialectical principles.''[6] French Marxists vehemently criticized Monod's views as implicitly anti-Marxist—a conclusion drawn explicitly by Monod himself. Lecourt, the first French Communist to meet Monod's challenge, does acknowledge troubling questions about the relationship of classical Marxism to the Stalinist theory and practice of science.[7]

For Lecourt, Lysenkoism's roots lie deep in the ontological version of dialectics, which became the official Soviet view and hence that of those Western European Parties under Soviet influence. Lecourt argues that the ontological version of Marxism does not by itself produce a theory of two sciences. But when assimilated to the classical Marxist thesis of philosophy as class-bound, it is the only logical conclusion.[8] That scientific concepts and theories have a class character, Lecourt asserts, follows from the linking of a dialectics of nature to the classification of all philosophies as essentially either idealist or materialist, with idealist theories as bourgeois and materialist theories as proletarian.

Lecourt devotes only a few pages to his thesis that a theory of two sciences is inherent in the ontological version of dialectics. But, *contra* Lecourt, I shall argue that Marxism does not require an ontological version of dialectics to produce the thesis that scientific theories serve either the interests of the bourgeoisie or the proletariat. That the theory of two sciences received its fullest development and its practical application in the orthodox Marxist tradition has created the misleading impression that a theory of the class character of science depends upon belief in a dialectics of nature. In fact, it depends upon a prior assignment of science to the superstructure—i.e., the cognitive content of science, for the relevance of class to other facets of science appears unproblematic.

Even Georg Lukacs, the original and perhaps most influential spokesman for a nonontological version of dialectics, assumed that scientific theories have a class character. He clearly intended to include the natural sciences in his thesis that all knowledge, including Marxism, is historical, relative, partial, and class-based.[9] Thus, Soviet Marxists attacked *History and Class Consciousness* for its relativization of the natural sciences as well as of Marxism. Lukacs' capitulation precluded any development of his views on the natural sciences. Nor were they developed by those ''Hegelian'' Marxists

for whom the work of Lukacs, and to a lesser extent Karl Korsch, provided inspiration.[10] Having rejected Engels' philosophic legacy, and with it the search for a dialectics of nature, Hegelian Marxists largely abandoned inter in the subject matter of much of Engels' and, to a lesser but still importa extent, Marx's concern. As a result, Marxism has split into essentially tw traditions: One has largely ignored the natural sciences; the other has pai them close attention but sometimes with disastrous results.[11]

Those who place the blame for the unhappy relationship of Marxism a the natural sciences on Engels' formulation of dialectical materialism, as in sense both ''Althusserian'' and ''Hegelian'' Marxists do, overlook the deep roots of the problem in Marx's and Engels' uncertain attitude toward the cla character of the natural sciences. Lecourt, for example, takes the view th any argument for the class character of scientific theories—not just the Stalinist—is, a priori, absurd and no part of classical Marxism. Absurd or n it certainly has roots in classical Marxism. Lukacs, after all, derived his vie from his reading of Marx, and it is a perfectly plausible, if not the only possible, reading. Nowhere is Marx's ambiguity more evident than in hi comments on Darwinism, the most significant scientific discovery of Mar own age but a theory the bourgeois origins—and content—of which are obvious. Perhaps no scientific theory has ever exhibited more openly its li to the world view of a particular class. Marx's inability to locate a secur standpoint from which to judge Darwinism, in spite of a long struggle to f one, reflected his uncertainty over the implications of this link and his uncertainty, in general, over the superstructural character of the natural sciences. For if the sciences are superstructural in the same way as, for example, politics or law, then it follows that no natural scientific theory can class-neutral. If they are not superstructural in this way, then in what way ar they, and with what consequences?

Marx and Engels implicitly raised but did not answer these questions. T failure of classical Marxism to provide a clear answer has encouraged development of a theory of two sciences independent of an ontological version of dialectics. Marxists cannot resolve the problem simply by rejecti Engels' philosophic views, which have had little general impact in any ca Ultimately, the problem of natural science is part of the larger problem, wh ''has plagued Marxism from its inception,'' of the relationship of base to superstructure.[12]

A full-blown theory of two sciences, however, developed only in the

orthodox Marxist tradition informed by Engels' understanding of dialectics as "the science of the general laws of motion and development of nature, human society and thought." [13] The burden of that tradition's insistence on a dialectics of nature—its consequences in theory and practice—may be illustrated by tracing the development of orthodox Marxist attitudes towards one scientific concept: Darwinian "gradualism."

"Natura Non Facit Saltum": A Case-study In The Relationship Of Marxism & The Natural Sciences

Did Marx share Engels' view? Or is the ontological version of dialectics, with its removal of the subject from an active role in changing history, antithetical to the spirit of Marx's own work? Disturbingly plausible cases have been made for both interpretations.[14] Whatever the truth, the orthodox tradition began with Engels, for he defined the philosophy and, in the *Anti-Duhring* and posthumously published *Dialectics of Nature*, applied it to the natural sciences. Engels identified three "laws" of dialectics, derived from Hegel's *Logic*: the law of the transformation of quantity into quality and vice-versa, the law of the negation of the negation, and the law of the mutual penetration of opposites. He considered the first, with its implication that both society and nature make "leaps"—that small continuous changes accumulate to produce a decisive transformation—as the central law.

Engels also thought Darwinism the conclusive proof of dialectics. Yet, Darwin had argued that natural selection operates through the extremely slow accumulation of slight variations. Evolution proceeds without discontinuities by small and continuous changes. For Darwin the theory of natural selection depended upon gradualistic assumptions: "If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down." [15] Quoting Linnaeus, he repeatedly proclaimed: "*Natura non facit saltum*." It would appear that no greater challenge could be presented to the Marxist dogma that nature always makes leaps than the Darwinian dogma that nature never does. How did Engels meet this challenge?

The chapter "Natural Philosophy: The Organic World" in the *Anti-Duhring* opens with a discussion of the ubiquity of leaps in nature. Engels writes:

> In spite of all intermediate steps, the transition from one form of motion to another always remains a leap, a decisive change. This is true of the transformation from the mechanics of celestial bodies to that of smaller masses on a particular celestial body; it is equally true of the transition from the mechanics of masses to the mechanics of molecules—including the forms of motion investigated in physics proper: heat, light, electricity, magnetism. In the same way, the transition from the physics of molecules to the physics of atoms—chemistry—in turn involves a definite leap; and this is even more clearly the case in the transition from ordinary chemical action to the chemistry of albumen which we call life. Then within the sphere of life the leaps become ever more infrequent and imperceptible.[16]

Apparently, leaps can be either large and dramatic or infrequent and imperceptible. Either way, they provide proof of dialectics.

Why did Engels not simply reject the gradualistic assumption of Darwin's theory? The most plausible explanation is that the only obvious nongradualistic alternatives in the 1870s and 1880s had little to offer. Cuvierian catastrophism asserted leaps, but Engels believed, wrongly, that it required repeated acts of special creation. Lyell's uniformitarian geology, which Engels praised highly, and Darwin's evolutionary biology provided a counter to Cuvier's theologically tainted catastrophism, which Engels labeled as "revolutionary in phrase and reactionary in substance." [17] Not until the turn of the century did an attractive alternative, which retained certain features of Darwinism while rejecting its gradualistic basis, present itself. And Marxists did enthusiastically embrace Hugo De Vries' *mutationstheorie*, which postulated the sudden appearance of new species. Later, De Vries theory itself became a casualty of Lysenkoism, for it could not survive the condemnation as "idealist" of all theories that assumed the existence of genes. De Vries also insisted that mutations were random—unrelated to the needs of the organisms in which they occur. Even Darwin had allowed some part of the origin of variation as a direct response to environment. The mutations theory therefore appeared, in spite of its assumptions that nature makes leaps, as a step backward from classical Darwinism.

Other Marxists, most notably Trotsky, preferred to represent speciation as a leap—to reinterpret the scientific theory rather than dialectics. For Trotsky Darwinism was "the highest triumph of the dialectic in the whole field of organic matter." Darwin was an "unconscious" dialectician who "demonstrated how an accumulation of small *quantitative* variations produces an entirely new biologic 'quality,' and by that token he explained the origin of species. Without being aware of it, he thus applied the method of dialectical materialism to the sphere of organic life."[18]

Trotsky notwithstanding, by no stretch of the imagination could the creation of new species in classical Darwinism be characterized as a leap, as Darwin himself and the Marxist mutationists recognized. According to Darwin, species merge imperceptibly one into another with no moment of decisive transformation—only a continuum. Darwin denied a marked division of varieties from species—a single point at which a new species appears—and affirmed only the slow and continuous transformation of one into the other.

Trotsky simply misunderstood Darwinism. Engels, however, never even confronted explicitly the seeming contradiction between Darwin's "*natura non facit saltum*" with the dialectical injunction that "the transition from one form of motion to another always remains a leap, a decisive change." Had he done so, he would have been forced to concede that Darwinism was undialectical. But he was reluctant to do so. Darwin's theory provided proof of historical development, however gradual, in nature and thus proof of dialectics in general, even if not obviously its first law.[19] By proving that species have a history, Darwin undermined conventional belief in their stability. Dialectics claims that nature is always in motion, always changing; Darwinism, that species are constantly being transformed one into another. Darwinism therefore struck a blow, in Antonio Labriola's phrase, "at the last citadel of the metaphysical fixity of things," making species "phases, as it were, and moments of real and proper natural history . . . ."[20]

Darwin's theory also provided a powerful refutation of the argument from design for the existence of God. The marvelous adaptations in nature, which hitherto had been explained as the acts of a Creator—design implies a Designer—received a rational, naturalistic explanation through the theory of natural selection. The eighteenth century conceived the structure of both the physical and biological worlds as testament to the wisdom and benevolence of

God. On the physical side Newtonian mechanics provided impressive suppo for the view that a static and perfect nature was the handiwork of God—a conclusion drawn explicitly and fervently by Newton himself. Hence, it is not surprising that Marx and Engels have no sympathy for Newton, thoug the degree of their hostility, especially Engels', is certainly extraordinary. Newton exhibits a "repugnance to thinking," is "a plagiariser and corrupter," a man who was right about very little but who, when right, was merely drawing out the implications of a Kepler, a Galileo, or a Descartes Darwin, however, had undermined the notion of fixity, had shown how species come into being and are transformed naturally, had made Divine intervention in the sphere of biology superfluous. This antitheistic aspect of Darwinism was, for both Marx and Engels, its most attractive element—on which generally overrode their other concerns about the scientific content an political implications of the theory.

Marx's and Engels' oft-quoted comments in praise of Darwin for dealing a "death-blow" to teleology are easily misinterpreted. All that Marx and Engels appeared to mean was that Darwin had developed a theory of evolutio without need or room for a Creator.[21] It was Darwin's antitheological views they found attractive; they had as much problem with the radically antiteleological implications of Darwinism as their contemporaries did. Tha evolution was opportunistic, that "whatever happened *might* have happene differently,"[22] was the radical message of Darwinism, but it was a message too radical for Marx and Engels who insisted that evolution be necessarily progressive. Marx even abandoned Darwinism temporarily in favor of a geological theory according to which changes in the earth's crust direct evolution upward. He wrote that this theory is "a very important advance ove Darwinism" in part because "Progress, which is pure chance with Darwin, is necessary here . . . ."[23] Engels, however, used Nietzsche's concept of "eternal recurrence" to reconcile his Darwinism and his teleology. Any event, however "accidental," had to occur and will necessarily recur in the future. Even if the universe runs down, "we have the certainty that matter remains eternally the same in all its transformations, that none of its attributes can ever be lost, and therefore, also, that with the same iron necessity that it will exterminate on the earth its highest creation, the thinking mind, it must somewhere else and at another time again produce it."[24]

Here, and in similar passages, Engels makes clear his assumption that

evolution had to create thinking human beings. In fact, Engels explicitly distinguishes the "old" teleology, which implies direction by an outside force (and is bad) from the "new" teleology, which is directed by "internal necessity" (and is good).[25] The ends, however, are remarkably alike. Hence, Monod referred to Engels' "animistic" spirit, his attempts to give nature "an ascending, constructive, creative intent, a purpose; in short, to render nature decipherable and morally meaningful."[26] Monod's accurate judgment is nonetheless unfair in its implication that the impulse to provide nature with purpose and direction is peculiarly Marxist. Marx and Engels were simply children of their age.

Engels' dilemma ought to be clear: The antitheistic implications of Darwinism depend upon acceptance of the mechanism of selection, and selection, in both Darwin's and Engels' view, works gradually. Darwinian gradualism obviously conflicts with the dialectical injunction that nature makes leaps. Engels avoided this potential conflict not by rejecting the gradualistic aspect of Darwinism or the theory in general but by broadening his notion of "leaps" to encompass even the most gradual of changes. Thus, he stretched the laws of dialectics to the point of vacuousness by making any scientific finding, concept, or theory a "proof" of dialectics. Trotsky preferred to stretch the scientific theory rather than the laws of dialectics. It comes to the same thing.

Anti-Duhring and the *Dialectics of Nature*, as well as many letters in the Marx-Engels correspondence, are filled with these harmless (because empty) "confirmations" of dialectical laws. So are works by Kautsky, Plekhanov, Trotsky, Bukharin, and Stalin, as well as numerous textbooks and popular expositions of the philosophy of "dialectical materialism." Lecourt has called this style the "minor mode" of dialectical materialism in which "Marxist philosophers set out to discover in the various sciences, after the event, 'applications' of dialectical materialism; 'applications' which given their external and *a posteriori* relation to the science, now have the peculiarity that they in no way change their 'object.'"[27]

But alongside this largely harmless, minor mode of dialectical materialism exists another—in Engels and all the other Marxist writers just cited—in which dialectics is taken seriously and used to judge scientific concepts and theories not a posteriori but a priori. Philosophy becomes the "queen of the sciences"; philosophers armed with dialectics are thought to be better

scientists than scientists themselves. Witness this remarkable passage from the *Dialectics of Nature*:

> Philosophy takes its revenge posthumously on natural science for the latter having deserted it; and yet the scientists could have seen even from the successes in natural science achieved by philosophy that the latter possessed something that was superior to them even in their own special sphere. (Leibniz, the founder of the mathematics of the infinite, in contrast to whom the inductive ass Newton appears as a plagiariser and corrupter; Kant, the theory of cosmic evolution *before* Laplace; Oken, the first in Germany to adopt the theory of evolution; Hegel, whose [encyclopaedic] comprehensive treatment and rational grouping of the natural sciences is a greater achievement than all the materialistic nonsense put together.

No wonder Engels felt secure in his rejection of the Second Law of Thermodynamics as "undialectical."

If Engels was ready to apply the test of dialectics to the theory of Clausius and Kelvin but not in practice to that of Darwin, others were willing to admit the inconsistency of Darwinian gradualism with dialectics. There are only three possibilities when orthodox Marxism confronts Darwinian gradualism. The first law of dialectics can be broadened to accommodate the scientific theory (Engels); the scientific theory can be broadened to accommodate the first law of dialectics (Trotsky); the conflict can be admitted and the scientific theory criticized as undialectical (Kautsky, Plekhanov, Bukharin). Kautsky et al. had available to them an attractive alternative that their predecessors lacked: De Vries' theory, developed at the turn of the century, according to which new species appear suddenly, without intermediate forms, as the result of giant mutations. It was now possible to be an evolutionist, even in some sense a Darwinian, since De Vries claimed only to be "developing" Darwin's theory, while rejecting the Darwinian assumption of slow and stately change. For the first time, dialectics and classical Darwinism were recognized as incompatible, with Darwinism treated as a reflection of bourgeois ideology. Kautsky notes that:

> While the bourgeoisie were still revolutionary, the catastrophic theory still ruled in natural science (geology and biology). This theory proceeded from the premise that natural development came through great sudden leaps. Once the capitalist revolution was ended, the place of the catastrophic theory was taken by the

> hypothesis of a gradual imperceptible development, proceeding by the accumulation of countless little advances and adjustments in a competitive struggle.[29]

Bukharin, Plekhanov, and many others make essentially the same point. The mutations theory, in spite of its assumption that variation is random, and evolution therefore undirected, remained immensely popular among orthodox Marxists in the period from about 1901-1930—that is, until it fell afoul of Lysenkoism.[30] In fact, the mutations theory was no more dialectical than classical Darwinism had been. According to De Vries, species are created all at once, without intermediate forms. If the law of transformation of quantity into quality and vice-versa is to have real content it ought to exclude both Darwinism in its classical form and its saltationist alternative. When the mutations theory eventually did fall into disrepute among Marxists, however, it was for entirely different reasons. De Vries' mutations involved genes—which, according to Lysenko, did not exist—and were random, as likely to be unfavorable or neutral as favorable with respect to the needs of organisms. In 1935 V.L. Komarov condemned the mutations theory in terms that would be repeated, with greater vehemence, many times in the future. He wrote:

> De Vries's theory of mutations on its ideological side, despite its outwardly revolutionary character (and there are revolutions in Nature), would hardly have been approved by Marx or Engels. The lack of cause in mutations, or more accurately the failure to explain the causes of the appearance of mutations connected with their lack of direction, . . . could hardly be approved by consistent supporters of dialectical materialism.[31]

Komarov turned Engels' praise of "slow development" in Lyell and Darwin and criticism of catastrophism against the mutationists. "We see that Engels recognizes 'slow changes' as the normal motive force of the process of evolution and does not express any desire to find other more rapid ones."[32] With that, the story of orthodox Marxism and Darwinian gradualism comes full circle. It is a story in which the actors, in the service of a dialectics of nature, were consistently forced to choose between the distortion of dialectics and the distortion of science, ironically as a way of avoiding conflict

between dialectics and science and the consequent judgment that "bourgeois" science was fundamentally unsound.

For most of its history orthodox Marxism has managed to combine respe for "bourgeois" science with the insistence that nature follows certain laws the operation of which would be obvious only to those armed with the philosophy of dialectical materialism. How could it be, Trotsky asked, tha "bourgeois" science, informed by an undialectical philosophy, should nevertheless afford so many proofs of dialectics? For Trotsky "bourgeois" science is "unconsciously" dialectical, much as for Lenin it was "spontaneously" materialist. Trotsky writes that:

> Every individual is a dialectician *to some extent or other*, in most cases, unconsciously. A housewife knows that a certain amount of salt flavors soup agreeably, but that added salt makes the soup unpalatable. Consequently, an illiterate peasant woman guides herself in cooking soup by the Hegelian law of the transformation of quantity into quality. Similar examples from daily life could be cited without end. Even animals arrive at their practical conclusions not only on the basis of the Aristotelian syllogism but also on the basis of the Hegelian dialectic. Thus a fox is aware that quadrupeds and birds are nutritious and tasty . . . . When the same fox, however, encounters the first animal which exceeds it in size, for example, a wolf, it quickly concludes that quantity passes into quality, and turns to flee. Clearly, the legs of a fox are equipped with Hegelian tendencies, even if not fully conscious ones. All this demonstrates, in passing, that our methods of thought, both formal logic and dialectic, are not arbitrary constructions of our reason, but rather expressions of the actual interrelationships in nature itself.[33]

For a theory of two sciences to develop out of the ontological version of dialectics, that version must first be taken seriously—as Trotsky almost never did. Lecourt suggests that a further element is needed: the thesis, first put forward by Engels in *Ludwig Feuerbach and the End of Classical German Philosophy*, that the history of philosophy is essentially the history of a struggle between idealism and materialism in which idealism has served reactionary, and materialism progressive, ends. Lenin made this thesis the basis of his intensely polemical work, *Materialism and Empirio-Criticism*. He proclaimed all philosophy part of the struggle of bourgeoisie and proletariat, with dialectical materialism the point of view of the latter.[34] From here, argues Lecourt:

> The thesis of the class character of science itself [imposes] itself straightaway as the inevitable conclusion to the argument: an intrinsic class character which does not now appear as the "enrolment of science" (Marx) in the service of capital, but is attached to the essential principles of its methodology and thus has effects in the constitution of its basic concepts and its theory. In these conditions, this thesis, too, has an inevitable corollary: "proletarian science" has to be counterposed to "bourgeois science" as the true science, conscious of its progress, to "pseudo-science," limited in its advances by the class horizons within which it emerged.[35]

And he notes that Lysenkoism was defended both on the basis of "its conformity to dialectical materialism *and* from its character as a 'proletarian science,' which comes to the same thing in this completely integrated 'logic.'"[36]

Actually, the thesis of the class character of philosophy is not essential for the creation of a theory of two sciences out of the ontological version of dialectics. Once it is determined that nature operates in accord with dialectical laws—that dialectics is "an absolute necessity for natural science"—it follows that scientists armed with the philosophy of dialectical materialism will have a greater insight into nature than others. Since bourgeois science is inherently undialectical, a proletarian science informed by Marxist principles must be essentially different—and superior. The thesis that all philosophy has a class character, and that dialectical materialism represents the point of view of the proletariat, only accentuates a conclusion already inherent in the premise of a dialectics of nature.

Materialism and Empirio-Criticism, as its title implies, primarily defends materialism—it had little to say about dialectics—against what Lenin took to be the idealist implications that philosophers and scientist-philosophers like Mach were drawing from modern physics. For Lenin all scientific theories are by definition materialist. Lenin's task, and that of such Leninist philosophers as Althusser and Lecourt, is only to draw out the materialist implications that must reside in scientific concepts and theories. The point of *Materialism and Empirio-Criticism* is to argue that no development in physical theory could possibly affect the truth of materialism. No scientific finding could count as evidence against a view held in this way. In Lenin's hands, therefore, this thesis becomes essentially harmless. He does not call Mach's science into question, at least not intentionally, but others remain free to take Lenin's

materialist demand more seriously than he himself did and put the sciences through an examination to determine whether they are in fact materialist. From there it is only a short step to the conclusion that those scientific theories that are both dialectical and materialist are also "proletarian." Hence, the theory of two sciences emerges—the theory reflected in Bukharin's judgment that "bourgeois science is in contradiction with the most fundamental requirements of all science."[37]

Lecourt is surely right in arguing that the logical implication of the ontological version of dialectical materialism is, ultimately, a theory of two sciences. But much of the history of orthodox Marxism is a history of the refusal to draw that conclusion—a history overshadowed by the dramatic and disastrous consequences of the Stalinist condemnation of genetics as "undialectical," "idealistic," and "reactionary." This historical refusal has taken various forms. One form simply denies that the conclusion follows. For example, Kautsky asserts, "The fact that an idea emanates from any particular class, or accords with their interests, of course proves nothing as to its truth or falsity." More often, "dialectics" and "materialism" (or the scientific theory) is interpreted in such a way that no theory could possibly be undialectical or idealist. Countering the tendency toward a theory of two sciences implicit in the orthodox tradition has been a powerful—in the end not powerful enough—countersentiment that science is not superstructural, not, in any important way, class-bound. Both Lenin and Trotsky defended at length the essential autonomy of the natural sciences. I say "essential" because to my knowledge no distinguished orthodox Marxist other than Kautsky ever argued that the truth of natural scientific concepts and theories is absolutely untainted by class-interest. Trotsky, echoed by Lenin, provided a particularly clear statement of this view:

> It can be said that the greater the trust of socialism in sciences devoted to direct study of nature, the greater is its critical distrust in approaching those sciences and pseudo-sciences which are linked closely to the structure of human society . . . . The need to know nature is imposed upon men by their need to subordinate nature to themselves. Any digressions in this sphere from objective relationships, which are determined by the properties of matter itself, are corrected by practical experience. This alone seriously guarantees natural science . . . from intentional, or semi-deliberate distortions, misinterpretations, and falsifications.[38]

The views of Lenin and Trotsky, among others, suggest that orthodox Marxists who assumed the sciences to be essentially objective found ways, in spite of their belief that scientists armed with the philosophy of dialectical materialism have a deeper insight into nature, not to denigrate the work of bourgeois scientists. Bourgeois scientific theories are "unconsciously" dialectical and materialist; they are, in spite of themselves, as it were, compatible with Marxism. Such a fiction can be maintained only at the cost of refusing to take either dialectics or materialism seriously.

Those orthodox Marxists who denied the autonomy of science drew the conclusion implicit in the ontological version of dialectics. But the notion of science as superstructural was logically prior. Dialectics and materialism only provided an easy standard by which to judge the "bourgeois" or "proletarian" nature of scientific theories. In other words, if one assumes the essential autonomy of natural science, the logical implications of the ontological version of dialectics will not be—historically have not been—drawn. If one assumes that the sciences are class-bound, those implications will be drawn in any case. Plekhanov, Bukharin, and Stalin did not need an ontological version of dialectics to develop a theory of two sciences. They needed only the assumption that class interests determine the content of the natural sciences in fundamentally the same way as they do the content of political, aesthetic, legal, or ethical forms. This thesis is an exaggerated and one-sided development of a tendency found in Marx's own writings on the natural sciences. The most obvious example of the tension in classical Marxism between the tendency to view the natural sciences as autonomous and the tendency to view them as class-bound is Marx's long and ultimately ambiguous attempt to come to terms with the Darwinian thesis that the mechanism of evolution is a struggle for existence.

Marx & Darwinism

Engels read *On the Origin of Species* before Marx did. On December 12, 1859 he wrote to Marx:

> The Darwin, which I am just reading, is really stupendous. Teleology in one respect had still not been finished off hitherto: it is now. Moreover, there has never yet been such a magnificent attempt made to demonstrate historical developm in nature, or at least not so happily. Of course, you have to pass over the cr English method.[39]

Marx was, if anything, even more enthusiastic. William Liebknecht recollects that "When Darwin drew the consequences of his investigatio and presented them to the public we spoke for months of nothing else bu Darwin and the revolutionizing power of his scientific conquests."[40] Ma himself wrote to Engels on December 19, 1860, "Although it is developed the crude English style, this is the book which contains the basis in natu history for our view."[41]

How Darwinism serves as a basis for the class struggle in history is neithe obvious nor explained by Marx. Probably, the exact way or ways in whi Darwinism supported the notion of historical class struggle were not clear Marx, either at the time he said it did or later. Many minor Marxists tried t derive socialism directly from Darwinian principles, provoking Darwin himself to remark: "What a foolish idea seems to prevail in Germany on th connection between Socialism and Evolution through Natural Selection." Engels, Kautsky, Labriola, Plekhanov, and other prominent Marxists, however, stressed the qualitative difference in the life of man and lower organisms and deplored this reductionist tendency. In Engels' pithy phras "animals collect, man produces." As a group, Marxists remained as divide and confused as everyone else over the social implications of Darwinism.

Marx's initial enthusiasm for Darwin is matched only by the depth of h later disenchantment. In 1866 he read a new book by an amateur geologist an explorer, Pierre Trémaux, entitled *The Origin and Transformation of Man and Other Beings*.[43] Trémaux argued that the nature of the soil largely determines the development of human races. Older (primary or secondary rocks are more "perfect" than newer ones; therefore, people who live on geologically recent terrain are less perfect, i.e., less beautiful, intelligent, industrious, independent, and progressive than those peoples who have th good fortune to dwell in areas of older terrain. On the mechanism by which rocks determine racial characteristics Trémaux is silent.

The whole book is as bizarre as this summary sounds. Even Engels remarked, though with little effect, "I have arrived at the conviction that ther is nothing to his theory . . . . This book is not worth anything, a pure

fabrication, which defies all facts and would have to give a proof for every proof which it adduces."[44] Marx, however, remained impressed, although he generally deferred to Engels on all natural-scientific matters except mathematics. In his first letter to Engels, Marx claimed that: "In its historical and political applications, Trémaux is much more important and fruitful than Darwin."[45] In response to Engels' criticism of Trémaux, Marx wrote, "Trémaux's basic idea on the influence of the soil is, in my opinion, an idea which needs only to be announced, to secure for itself once and for all the right of citizenship in science . . . ."[46]

Why should Marx have been so impressed by a theory that can only be characterized, even by nineteenth-century standards, as fantastic? Marx does note a number of scientific criticisms leveled against Darwinism, e.g., the problem of hybridization, the apparent fixity of species, gaps in the fossil record—which are given a "rational" explanation by Trémaux. But it hardly appears credible that Marx favored Trémaux over Darwin on scientific grounds. There were, in the mid-1860s, many scientifically troublesome aspects of the theory of evolution by natural selection. To criticize Darwin's theory, even to reject selection as an important agent in evolution, was not in itself irrational. To reject it on behalf of Trémaux's alternative was a different matter.

Trémaux provided scientific support for Marx's racial-national views, which were typically nineteenth-century German, no better and no worse. "Here alone," wrote Marx, "is found a natural basis for certain questions, as of nationality, etc." In particular, Trémaux supported Marx's and Engels' view of the South Slavs as a deficient people without a past or a viable future. He approvingly quotes Trémaux's remark that: "The Slav and Lithuanian races have their true boundary with the Muscovite in the great geological line which extends north of the basins of the Nieman and Dnieper. To the south of this great line the capacities and types of men proper to this region are and will always remain different from those of Russia."[47]

Marx also saw in Trémaux an alternative to the nondirected character of Darwinian evolution in which "progress" depends upon the chance occurrence of variations. In Trémaux, Marx noted, progress is a necessary consequence of the development of the earth (literally), newer soil producing better organisms. Also, Trémaux suggested that man can now, to some extent, control his own evolution through modification of the soil. Marx

extended Trémaux's theory to the historical influence of human action on th soil. "I myself," he wrote, "consider among those historical modification also the chemical change of the soil surface by agriculture, etc., also the different influence which under different methods of production, such thin as coal deposits, etc. have."[48] Geology determines evolution, but man, in t past unconsciously and in the future consciously, can to some degree at lea affect geology. Though largely deterministic—improvement is natural sinc newer terrain produces better organisms—Trémaux's theory allowed for th possibility of human action in shaping the course of evolution. It was, in short, a theory with all the advantages of Darwinism but none of the disadvantages. It had, in fact, only one failing: It was a theory perceived patently absurd by nearly everyone except Marx.

As early as 1862 Marx was troubled by certain features of Darwinism, particularly the relationship of the Malthusian population principle (that "libel on the human race") to the theory of natural selection. Less than a yea and a half after Marx claimed that Darwinism would serve "as a basis in natural science for the class struggle in history," he wrote to Engels:

> Darwin, whom I have looked up again, amuses me when he says he is applying th "Malthusian" theory also to plants and animals whereas the whole point of M Malthus lies in the fact that he does *not* apply his theory to plants and animals, bu *only* to men—with geometric progression—as opposed to plants and animals. It i remarkable how Darwin recognizes among the beasts and plants his English society with its division of labor, competition, opening up of new markets, "inventions," and the Malthusian "struggle for existence." It is Hobbes's *bellum omnium contra omnes*, and one is reminded of Hegel in the *Phenomenology* in which civic society is expressed as the "spiritual animal kingdom" whereas with Darwin the animal kingdom represents civic society.

At least one thing is clear from this passage, and perhaps one thing only: B 1862 Marx was already focusing on the nature of the relationship of Malthu to Darwin—a relationship that has continued to trouble Marxists to the prese day.[50] He charged Darwin with misreading Malthus since Darwin thought he was applying to nature a theory the force of which in fact depends on the contrast between the world of plants and animals and that of man. When Darwin wrote, in the introduction to *On the Origin of Species*, that the struggle for existence "is the doctrine of Malthus, applied to the whole anim

and vegetable kingdoms" he failed to understand, according to Marx, that Malthus' theory presupposes a distinction between man and the rest of nature.

Marx recognized that even if Darwin was wrong in claiming that the theory of natural selection is nothing more than the Malthusian doctrine applied to the life of plants and animals, he did obtain from his reading of the *Essay on Population* a heightened sense of the importance in nature of a constant struggle for existence. The exact nature of the link between Malthusianism and natural selection may be problematic, but that a link existed was made explicit by both Darwin and Wallace in a number of contexts and recognized by Marx.[51]

The exact nature of Malthus' influence on Darwin has been a matter of scholarly dispute, but it is generally agreed to have been large.[52] The general public in Marx's time assumed a substantial link between the theory of natural selection and the Malthusian principle of population. No wonder Marx fretted that Malthusianism in politics would appear to acquire scientific support from its application to biology. Thus, he stressed that it was not—Darwin's comments notwithstanding—the whole Malthusian doctrine which had been applied, with such vast success, to the world of nature. But Darwin had indeed obtained a vital element in this theory from Malthus. Darwin may not have got from Malthus all he said he did, but even Marx had to admit that he had got something important. In painfully obvious fact, the hated Malthus, who maintained that poverty inevitably resulted from a biological law of overpopulation and was therefore impervious to changes in political and economic structure, had significantly influenced development of the theory of natural selection.

The ambiguity of the rest of Marx's comment, as well as other comments by Marx, and by Engels to which Marx apparently assented, suggests that he was uncertain how to respond. He said that Darwin had read into the world of nature the characteristics of his own society. Viewing the world through the spectacles of the English bourgeoisie, Darwin saw all the forms of his own world with its "division of labor," "competition," "opening up of new markets," "inventions," and "the Malthusian 'struggle for existence,'" mirrored in the life of plants and animals. Could Darwin's description of nature, based as it was on the misunderstanding of a theory misconceived even in its own sphere, nevertheless be true? To this question Marx gives no

clear reply. When Komarov, at the beginning of the Lysenko period, w
that it is difficult "to define Marx's attitude toward the struggle for exist
and natural selection," he is right.[53] Marx noted the class content, the
bourgeois aspect, of Darwinism but never frankly addressed the questio
raised. In approximately two decades of musing on the theory of natura
selection, neither Marx nor Engels offered a clear statement of the
relationship between its truth and its class content.

Marx remained fascinated by Darwinism until the year of his death.[54] B
Marx and Engels wrote a great deal about Darwinism, perhaps more tha
know, since there apparently remain unpublished manuscripts, includin
some on science, at the Marx-Engels Institute in Moscow. During Mar
own more than twenty-year struggle to come to terms with Darwinism,
sometimes appeared a fervent supporter, sometimes a severe critic; in h
most lengthy and thoughtful comments, however, he emerged as a man w
doubts he apparently did not know how to resolve. Hence, the ambiguity
both individual passages and his comments as a whole—an ambiguity that
had serious consequences. Komarov wrote that perhaps had Darwin "n
dragged Malthus in by the hair, it [Marx's attitude toward natural selectio
would have been a quite different one, and Marx would not have been
compelled to say that Darwin was transferring to plants and animals the
peculiarities of the English capitalist system."[55] But Darwin did drag
"Malthus in by the hair," thereby raising questions for Marx, whose fail
to provide an unambiguous answer would haunt Marxism a half century l
when Marx's (and Engels') remarks on Darwinism would be repeatedly
cited by Lysenko and his followers.

The theory of two sciences found its most brutal expression in the lon
reign of Lysenko. But Lysenkoism had its corollaries in other sciences,
including physics, cybernetics, mathematics, formal logic, and chemistr
"Theories of chance" came under particularly heavy attack. In 1948, fo
example, it was proclaimed that: "Lenin and Stalin solved the basic nod
problems of the science of statistics . . . . It is a matter of honour for Sov
statisticians to conduct a militant Party criticism and to unmask bourgeoi
statistics, the worthlessness of its 'scientific' bases, its decay, its impoten
and its apologetic role, and also to uproot all signs of obsequiousness to
bourgeois science."[56] The search for bourgeois tendencies even in biolog
moreover, long predated Lysenko's influence. Lysenkoism itself represent

a practical application in one sphere of a general theory, presented in its most extreme form after 1948, arguing that the truth of natural scientific ideas is a function of their class basis. But it is also a theory with roots buried deep in Marxism. However horrified most Marxists might be at its development and application under Stalin, those who have thought seriously about the natural sciences at all have held some kind of theory, however muted, of two sciences. Even Lenin and Trotsky, who wished in practice to defend the autonomy of natural scientific theorizing, believed the sciences to have been to some extent compromised by the class interests they have historically served. But they argued that, in contrast with the almost worthless social sciences, the distortions were so small that, for all practical purposes, they could be ignored. Plekhanov, Bogdanov, Bukharin, Deborin, Zhdanov, on the other hand, viewed bourgeois science with real suspicion and assumed that the natural scientific heritage of the past was tainted in a serious way.

This view did not originate with Russian Marxists. It first appeared explicitly in the post-Darwin era in relation to the serious, and at the time largely unanswerable, criticisms leveled at the theory of natural selection—criticism that reached its peak about the turn of the century. (The mutations theory was one response to this criticism.) A view expressed uncertainly and ambiguously by Marx was expressed unambiguously by Ernest Untermann—to be echoed by Plekhanov and Bukharin—in his 1905 book on evolution.

> I declare that my science is a proletarian science. Not that I do not appreciate what the bourgeois scientists of the past have accomplished, or what the bourgeois scientists of to-day are doing in the way of accumulating material for the storehouse of human knowledge. But proletarian science is the expression of the revolutionary fact that the proletariat has learned to think for itself, that it prefers to think for itself in all other sciences as it does in economics and politics, that it interprets the facts of its territorial and cosmic environment as it sees them from its own standpoint.
>
> Proletarian science is the Declaration of Independence of the proletarian mind from the control of the capitalist mind. And since the proletariat is historically the most revolutionary class in society, and the future man in embryo, proletarian science is the most revolutionary science and the embryo of the future world philosophy.[57]

Lecourt notwithstanding, a theory of two sciences did not wait upon Stalin; was an explicit feature of the Marxist response to Darwinism as early as th turn of the century.

It was not the only response. In a sense, almost all orthodox Marxists hav held the natural sciences to be superstructural in some way, but this assumption has been compatible with an extraordinarily wide range of attitudes toward the practice of science, from Stalin's at one extreme to Lenin's and Trotsky's at the other. The essential question, therefore, has r been whether science is in some sense superstructural. Darwinism was in fa the generalization to nature of the bourgeois world view; both the theory natural selection and the gradualism that underlies it reflect liberal ideolog Alone among orthodox Marxists, Karl Kautsky asserted the irrelevance of t fact to the theory's truth or falsity, and he rejected gradualism anyway as undialectical. For the others the significance of science as superstructural ha received a variety of responses, the most extreme being the Stalinist: A completely new proletarian physics, chemistry, mathematics, and biolog must replace the bourgeois sciences.

The wide variety of responses reflects the ambiguity toward the natura sciences expressed in Marx's own writings. It is an ambiguity much like th which has bedeviled Marxism in the realm of ethics, and with analogous consequences. Marx considered ethics superstructural; i.e., he believed th the ethical norms of any society inevitably reflect the interests of the ruli class. In a dispute between classes, therefore, it is not possible to appeal moral concepts above class—to transcendent norms binding equally on th proletariat and bourgeoisie. All such appeals to a "classless" morality mu in fact favor one class over another.

But if the proletariat is right to reject the constraints of "bourgeois" morality, what, if anything, binds it in its revolutionary struggle? One possible answer, the one actually given by most orthodox Marxists, is—nothing. Lenin's formulation is particularly clear: "Our morality is completely subordinated to the interests of the class struggle of the proletariat . . . . Morality is that which serves to destroy the old exploiting society."[58] Eduard Bernstein gave the other historically important answer his attempt to provide a Kantian basis for Marxism. Critics of Bernstein, suc as Kautsky or Rosa Luxemburg, were certainly right in criticizing his appe to the categorical imperative as a return to that pre-Marxist "morality abov

class and above society which Marx condemned."[59] But their work, like Marx's own, was essentially destructive in its impact and left open the question how socialist morality in fact differs from bourgeois. For those who do not specify its nature in some detail leave the door open to the kind of crude utilitarianism represented by Lenin's famous remark that "everything that is done in the proletarian cause is honest" and to Stalinism. Unless the norms that bind the proletariat are clear, the tendency in practice will be to justify any action that appears to forward the cause of socialism.

That such a morality is far from the spirit of Marx's own work is easy to grant. But except for a few lines on the "simple laws of ethics and justice" that should inform relations among men, Marx does not explicitly say what moral principles must actually bind the proletariat in its struggle against capitalism. He is "at best allusive" here.[60] Marx was no utilitarian—much less a crude one—but he made a utilitarian interpretation of Marxism possible, and perhaps even inevitable, by his failure to specify the content of socialist morality. In the same way, the failure to specify in what ways and with what consequences science is class-bound, permitted the development of a full-blown theory of two sciences. In relation to both ethics and science, Marxism has raised more questions than it has resolved. Harsh as it may sound, Stalinist science, like Stalinist ethics, has roots reaching back to Marx, though less in what Marx said than in what he omitted and therefore allowed others to argue in his name. The interpretations of Plekhanov, Bukharin, Deborin, Zhdanov, et al. have so far been ignored—not answered—by Western Marxists.

Notes

1. Louis Althusser, *For Marx* (London, 1968), 1.

2. Two influential works which dismiss any link between Lysenkoism and classical Marxism are: David Joravsky, *The Lysenko Affair* (Cambridge, Mass., 1970) and Loren Graham, *Science and Philosophy in the Soviet Union* (New York, 1972). These authors were perhaps reacting to earlier scholarship which assumed a much too simple and straightforward link between Marxist ideology and Stalinist biology. Another work, written from a first-hand perspective, is Zhores A. Medvedev's fascinating *The Rise and Fall of T.D. Lysenko* (New York, 1969). Three recent articles by Marxists that indicate a partial sympathy for Lysenko's attempt to create a popular, radical science are: Richard Lewontin and Richard Levins, "The Problem of Lysenkoism," in Hilary and Steven Rose, eds., *The Radicalisation of Science*

(London, 1976), 32-64; Gary Werskey, "Science and Ideology in the Soviet Union," *Britis Journal for the History of Science*, No. 8 (1975), 240-244 (a review essay of Joravsky's book) Bob Young, "Getting Started on Lysenkoism," *Radical Science Journal*, Nos. 6/7 (1978) 81-105. A very different Marxist perspective informs the work of Filippo Belardelli, "The 'Lysenko Affair' in the Framework of the Relations Between Marxism and the Natural Sciences," *Scientia*, CXII (1977), 33-50, and that of Dominique Lecourt whose recent book *Proletarian Science? The Case of Lysenko* (Manchester, 1977), is highly original, provocativ sometimes maddening, and much too short. The first serious attempt to analyze Lysenkois from a Marxist standpoint, it has deeply influenced my own thinking on the relationship o Marxism and the natural sciences. Joravsky reviews Lecourt's work rather harshly in "Th Scientist as Conformist," *New York Review of Books* (Oct. 12, 1978), 37-41.

3. Quoted in Lecourt, *Proletarian Science?*, 23-24.

4. P.W. Brian, "The Situation in Biological Science II," *Modern Quarterly*, IV (1949), 29

5. Lecourt, *Proletarian Science?*, ch. 5.

6. Jacques Monod, *Chance and Necessity* (New York, 1971), 40.

7. See Lecourt, *Proletarian Science?*, 101 for the French Communist reaction to Monod's book. According to Lecourt, it was the "conjuncture" of the ontological version of dialectic and what he terms Stalinist "technicism" that produced the theory of two sciences. It is a re weakness of Lecourt's account that he fails to consider, except for Bogdanov and the "Proletkult," the history of the theory of two sciences before 1948. It therefore appears as the consequence of Stalinist philosophy *cum* Stalinist technicism. But even in Russia, the conce of a "proletarian" science has a long history and many proponents, including Plekhanov, Bukharin, and the *Vpered* (Forward) group prior to the Russian Revolution.

8. See his essay, "Reification and the Consciousness of the Proletariat," in *History and Clas Consciousness* (Cambridge, Mass., 1971).

9. An account of the Soviet attack on Lukacs is presented by Maurice Merleau-Ponty in *Adventures of the Dialectic* (Evanston, Ill., 1973). See his chapter, "Pravda."

10. Korsch is sometimes charged with holding views in regard to the natural sciences to which it is far from clear that he suscribed. See, for example, Alex Callinicos, *Althusser's Marxism* (London, 1976), 55. Korsch does use the terms "bourgeois science" and, at leas once, "bourgeois natural science" but with no clear meaning (at least to me). Karl Korsch *Marxism and Philosophy* (New York, 1970), 69.

11. There are, of course, exceptions. The "Austro-Marxists," with ties to the Vienna Circle, especially through Otto Neurath, were seriously concerned with the natural sciences and thei relevance to Marxism. However, though important in the first two decades of this century, the exerted only a minor influence on the development of Marxist theory and are little read today "Althusserian" Marxists have also been concerned with various aspects of the natural sciences, upholding "materialism" in philosophy and the view that natural scientific concepts and theories are essentially autonomous, rather than class-bound. What is sometimes calle "Hegelian" or (in Merleau-Ponty's phrase) "Western" Marxism has in general exhibited spirit of hostility toward the natural sciences, no more so than in the case of "critical theory" (the Frankfurt School). However, Jürgen Habermas has departed in this respect, as in some other important respects, from the critical-theory tradition in the attention he has paid to philosophical issues raised by the natural sciences.

12. The phrase is Eugene Genovese's.

13. Engels to Conrad Schmidt, Nov. 1, 1891, *Marx-Engels Werke*, XXXVIII (Berlin, 1966). All citations of letters, unless otherwise indicated, refer to the *Werke*.

14. The view that Engels' "dialectical materialism" is a conception absent from Marx's own work and contrary to its spirit is forcefully expressed by George Lichtheim in *Marxism: An Historical and Critical Study* (New York, 1961), esp. 244-258. A different view, and one much closer to my own, is presented by Gareth Stedman Jones in "Engels and the Genesis of Marxism," *New Left Review*, No. 106 (1977), 79-104.

15. Charles Darwin, *On the Origin of Species*, 1st. ed. (Cambridge, Mass., 1964). Darwin also wrote: "Why should not Nature take a sudden leap from structure to structure? On the theory of natural selection, we can clearly understand why she should not; for natural selection acts only by taking advantage of slight successive variations; she can never take a leap, but must advance by the shortest and slowest steps." (p. 194). Not all Darwinists agreed. Both Francis Galton and T.H. Huxley stressed the discontinuous nature of evolutionary change. My interest in this problem was originally stimulated by the work of Professor Stephen Jay Gould, a paleontologist and historian of science, who has argued forcefully in a variety of scholarly and popular journals that Darwin's gradualism was essentially the generalization to nature of the political and social biases of the English bourgeoisie—biases that led him to link his theory of natural selection to an assumption about evolutionary rates which was both unnecessary and false. See, for example, his "Evolution's Erratic Pace," *Natural History*, LXXXXVI (1977), 12-16. I am greatly indebted to Professor Gould for his many and patient explanations of various aspects of the history of evolutionary theory and, even more, for his encouragement to pursue a line of argument that is, in some respects, at variance with his own.

16. Frederick Engels, *Herr Eugen Duhring's Revolution in Science* ("*Anti-Duhring*") (New York, 1939), 75.

17. Frederick Engels, *Dialectics of Nature* (New York, 1940), 10.

18. Leon Trotsky, "Dialectical Materialism and Science," speech delivered on Sept. 17, 1925. Reprinted in *Problems of Everyday Life; And Other Writings on Culture and Science* (New York, 1973), 216.

19. Engels wrote: "Nature is the proof of dialectics . . . . In this connection, Darwin must be named before all others. He dealt the metaphysical conception of nature the heaviest blow by his proof that all organic beings . . . are the products of a process of evolution going on through millions of years." *Socialism: Utopian and Scientific* (New York, 1935), 48.

20. Antonio Labriola, *Essays on the Materialistic Conception of History* (Chicago, 1908), 114.

21. Erhard Lucas also makes this point. See his article, "Marx und Engels Auseinandersetzung mit Darwin zur Differenz Zwischen Marx und Engels," *International Review of Social History*, IX (1964), 433-469.

22. Marjorie Greene, "On the Nature of Natural Necessity," in *The Understanding of Nature: Essays in the Philosophy of Biology* (Dordrecht, Holland, 1974), 232.

23. Marx to Engels, Aug. 7, 1866, XXXI.

24. Engels, *Dialectics of Nature*, 23-24.

25. Engels writes: "The old teleology has gone to the devil but the certainty now stands firm

that matter in its eternal cycle moves according to a law which at a definite stage—now here, now there—necessarily gives rise to the thinking mind in organic beings." Ibid., 187. Also: "When Hegel makes the transition from living to knowing by means of propagation (reproduction), there is to be found in this the germ of the theory of evolution, that, organic life once given, it must evolve by the development of the generations to a genus of thinking beings." (p. 229) Some recent Marxist philosophy has an equally orthogenetic cast. See, for example, Walter Hollitscher, *Die Natur der Wissenschaft* (Vienna, 1969).

26. Monod, *Chance and Necessity*, 39.

27. Lecourt, *Proletarian Science?*, 117.

28. Engels, *Dialectics of Nature*, 154-155.

29. Karl Kautsky, *The Social Revolution* (Chicago, 1902), 12.

30. Plekhanov wrote, "... during the last two decades the theory which sees only gradual changes in the process of development has begun to lose ground even in biology, where it used to be recognized almost universally. In this respect, the work of Armand Gautier and that of Hugo de Vries seem to show promise of epoch-making importance. Suffice it to say that de Vries' theory of mutations is a doctrine that the development of species takes place in leaps." George V. Plekhanov, *Fundamental Problems of Marxism* (New York, 1969), 46-47. Cf. Nikolai Bukharin, *Historical Materialism* (New York, 1925), 81-82.

31. V.L. Komarov, "Marx and Engels on Biology," in N.I. Bukharin, ed., *Marxism and Modern Thought* (London, 1935), 223.

32. Ibid., 229.

33. Leon Trotsky, "An Open Letter to Comrade Burnham," Jan. 7, 1940, in *In Defense of Marxism* (New York, 1973), 84 (original emphasis).

34. A modern and equally extreme restatement of this position is the essay by Louis Althusser, "Lenin and Philosophy," in the collection by the same name (New York, 1971). Althusser provides no more evidence than Lenin for the thesis that all philosophies are either idealist or materialist and that all idealist theories are reactionary, all materialist theories progressive. As Robert Cohen has noted: "Specific idealisms, specific materialisms and specific positivisms have certainly played their ideological roles, but it is clearly necessary that we be wary of generalizations about *Weltanschauungen* which cross cultures or epochs . . . . If, for example, we consider empiricism, rationalism, and mysticism, three attitudes toward nature and society which are known to occur in quite different social settings, the variety of social roles which these three philosophic attitudes may play becomes evident. At various junctures, rationalism has undermined superstition, empiricism has shaken dogma, mysticism has revolted against orthodoxy. At other times, rationalism has codified oppression, empiricism has sceptically ridiculed social reconstruction, mysticism has led to a retreat from reality." Robert S. Cohen, "Dialectical Materialism and Carnap's Logical Empiricism," in Paul A. Schlipp, ed., *The Philosophy of Rudolf Carnap* (LaSalle, Ill., 1963), 132-133.

35. Lecourt, *Proletarian Science?*, 112.

36. Ibid., 112-113.

37. Bukharin, *Historical Matrialism*, 82.

38. Trotsky, "Dialectical Materialism and Science," *Everyday Life*, 208. See also Lenin's

essay,."On the Significance of Militant Materialism" (1922), in *Collected Works* XXXIII (1966), 227-236.

39. Engels to Marx, Dec. 12, 1859, XXIX.

40. William Liebknecht, *Biographical Memoirs* (Chicago, 1908), 91-92.

41. Marx to Engels, Dec. 19, 1860, XXX. See also Marx to Lasalle, Jan. 16, 1861, XXX.

42. Darwin to Dr. Scherzer, Dec. 26, 1879, quoted in Francis Darwin, ed., *The Life and Letters of Charles Darwin* (New York, 1911), II, 413.

43. Pierre Trémaux, *Origine et Transformation de l'homme et autres êtres*. Part I (Paris, 1865). For a discussion of this book see Diane Paul, "'In the Interests of Civilization': Marxist Views of Race and Culture in the Nineteenth Century," *Journal of the History of Ideas* (forthcoming).

44. Engels to Marx, Aug. 10, 1866, XXXI.

45. Marx to Engels, Aug. 7, 1866., XXXI.

46. Marx to Engels, Oct. 3, 1866, XXXI.

47. Marx to Engels, Aug. 7, 1866, XXXI.

48. Marx to Engels, Oct. 3, 1866, XXXI.

49. Marx to Engels, June 18, 1862, XXX.

50. For example, see Semen R. Mikulinsky, "Internalism-Externalism Controversy as a Phony Problem," in E.G. Forbes, ed., *Human Implications of Scientific Advance: Proceedings of the XVth International Congress of the History of Science* (Edinburgh, 1978). He writes: "There have been numerous attempts to explain the appearance of Darwin's theory by the influence exercised on Darwin by Malthus' 'Essay on Population.' It was Darwin himself who was to some extent responsible for this version. Those who advanced it, however, did not pay attention to the fact that after having mentioned in his *Autobiography* the book of Malthus, Darwin immediately made a statement that he 'was well prepared to appreciate the struggle for existence which everywhere goes on.'" (p. 99) See also Valentino Gerratana, "Marx and Darwin," *New Left Review*, No. 82 (1973), 60-82, esp. 70-75.

51. For example, see *The Autobiography of Charles Darwin*, Nora Barlow, ed. (New York, 1958), 120. See also Wallace's speech to the Council of the Royal Society upon receiving the first Darwin-Wallace Medal, July 1, 1908 in *Alfred Russel Wallace: Letters and Reminiscences*, James Marchant, ed. (London, 1916), 116.

52. See especially Robert M. Young, "Malthus and the Evolutionists: The Common Context of Biological and Social Theory," *Past and Present*, No. 43 (1969), 109-141. For a summary of recent work, see Silvan S. Schweber, "The Origin of the *Origin* Revisited," *Journal of the History of Biology*, X (1977), 229-316.

53. Komarov, in Bukharin, ed., *Marxism and Modern Thought*, 197.

54. Until recently, most scholars have assumed that Marx's mature attitude toward Darwinism must have been highly favorable—how else explain his desire to dedicate *Capital* in his honor? However, due to the detective work of Lewis Feuer and Margaret Fay (working independently), we now know that Darwin politely declined the dedication of Edward Aveling's *The Student's Darwin*, not Marx's *Capital*. See Lewis S. Feuer, "Is the 'Darwin-Marx Correspondence' Authentic?" *Annals of Science*, XXXII (1975), 1-12, and comments in the following two

articles: Margaret A. Fay, "Did Marx Offer to Dedicate *Capital* to Darwin?" *Journal of the History of Ideas*, XXXIX (1978), 136-146, and Isaiah Berlin, "Marx's *Kapital* and Darwin," *Journal of the History of Ideas*, XXXIX (1978), 519. Feuer has recently provided an account of the attempt to determine the authenticity of the "Darwin-Marx Correspondence" including some speculation as to how the original mistake in attribution was made and why it persisted, in "The Case of the 'Darwin-Marx' Letter," *Encounter*, LI (1978), 62-78.

55. Komarov, in Bukharin, ed., *Marxism and Modern Thought*, 197.

56. Quoted in Julian Huxley, *Heredity East and West: Lysenko and World Science* (New York, 1969), 170.

57. Ernest Untermann, *Science and Revolution* (Chicago, 1905), 7-8.

58. Quoted in Robert Conquest, *Lenin* (New York, 1972), 34-35.

59. Alasdair MacIntyre, *A Short History of Ethics* (London, 1966), 214. See also his discussion in *Against the Self-Images of the Age: Essays on Ideology and Philosophy* (New York, 1971), 91-93.

60. MacIntyre, *Ethics*, 214. Eugene Kamenka comments, "An anthology entitled *Marx and Ethics* would contain no passages that continue to be strictly relevant for more than three or four sentences." Kamenka, *Marxism and Ethics* (London, 1969), 6.