even contended that Lysenko should be assisted to maintain his grip. The argument runs approximately as follows. So far as theoretical science is concerned, the so-called Michurinist biology is merely ludicrous. But Lysenko uses his "theories" in activities that are economically very important, like plant and animal breeding and general direction of agriculture. His influence in these affairs cannot help being disastrous, at least in the long run. Regardless of whether they know it or not, Lysenko and his followers are highly efficient saboteurs who weaken the economic fabric of the lands in which they secure domination. This activity is useful in cold war; it may be even more important in hot war.

This writer believes that the foregoing argument involves an ethical issue which should be discussed publicly. Like other humans, scientists are often mistaken; but no scientist should maintain scientific opinions that he knows to be untrue. Some confidence in each other's veracity and integrity is indispensable among scientists if science is to endure and to advance. Competent biologists know that Lysenko's theories are compounded of ignorance or fraud. These theories represent chiefly revivals of outworn notions which were current in scientific biology, mainly during the last century, and which were discarded, one by one, because they were shown, to the satisfaction of at least a large majority of biologists, to be invalid or useless. Of course, the history of science knows instances when a view that was temporarily abandoned eventually came into its own. But the very fact that Lysenko claims these theories to have been invented by Michurin or by himself shows that he either does not know or does not admit their real origin.

It is a remarkable and significant fact that among the many competent geneticists who worked in the U.S.S.R. prior to the establishment of Lysenko's domination in 1948, only one, Noujdin, has become an active protagonist of Lysenko's views. Concerning the others, the information is very scanty. To judge by the contents of the Russian scientific periodicals, those of the geneticists who remain alive and well have either abandoned biological research altogether or switched to "safe" topics. Despite all the threats and inducements they have not followed Lysenko. In the West, a majority of biologists have treated the Michurinist biology with contemptuous silence. To be sure, several books have been published in Lysenko's defence by authors whose primary competence lies in fields not too closely related to Lysenko's main activities. The origins of these books constitute an interesting problem in social psychology. Anyway, it is indisputable that Lysenkoism has very few followers among biologists outside of countries in which its acceptance is prescribed by governmental authority.

To urge that Lysenko's domination of the whole or of a part of biology in several countries is desirable means, then, to wish to perpetuate what a great majority of biologists consider to be an untruth. The present writer believes this to be incompatible with the moral obligations of a scientist. We should desire that scientific enlightenment penetrate everywhere, including the countries which are, for the time being, hostile to us. Let us admit that this involves a calculated risk. Science can be used for good as well as for bad ends. But it is perhaps not overoptimistic to believe that truth will ultimately make us free. Furthermore, a distinction must be drawn between basic science and technological knowledge. Some of the latter may and should be kept secret under certain circumstances. The former should not. Granted that the distinction will at times not be easy to make, it is our collective responsibility to make it. Basic biology certainly should not be made a weapon in any war. The very fact that such an ethical problem could have arisen is distressing; it shows the utter absurdity of a divided world.

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April 8, 1954.

A Challenge to Law

Lawson McKenzie's article on "Scientific property" [*Science* **118**, 764 (1953)] is something of a challenge to the changing law. Perhaps the law can contribute something to improving the social stature of the scientist by offering him new rights and responsibilities. If so, it could at the same time go a long way toward strengthening the weakest link in the chain of application of science generally.

The scientist enjoys a great deal of freedom but sometimes overlooks the fact that freedom implies responsibilities. One of his duties to his fellowmen is to see, as far as he reasonably can, that the fruits of his labor are accessible to all who can profitably harvest them, and not only to his fellow-scientists.

The scientist in the "ivory tower" is the greatest obstacle to the application of science to the common weal. He is likely to resent seeing his work reported in the popular press in what appear to him to be crude and inaccurate terms. He should reflect that there is no absolute truth—at least as far as expression in words is concerned, or even in thoughts. Different people have different habits of thought, and the scientist's—particularly if he has been trained in the "exact" sciences—are really very stylized. He can be about the worst person to choose for the task of getting his work applied in industry or agriculture. Moreover, he sometimes resents another person's cashing in on his discoveries. This is unjustified, for his rewards accrue from his reputation, as McKenzie observed, and all his work goes to his credit—even null results count. He is concerned with discovery, not invention. If he feels resentment at exploitation of his work by others, he should bear in mind that nothing succeeds like success; efforts to apply the fruits of scientific research fail much more often than they succeed, and an inventor or consultant benefits little from all his failures.

A lack of appreciation of the fact that science and

its application call for totally different disciplines of mind is responsible for much of the scientist's resentment in such instances. He has a sense of property in his creative mental work, but the law has not yet found a way to recognize this. If it does, then I venture to suggest that scientists will be bigger and better men and that the time lag in the application of science to industry, agriculture, and professional practices will diminish.

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April 20, 1954.

D. R. Rexworthy's letter suggests an increasing social responsibility of the "ivory tower" scientist. I obliquely refer to this in a discussion of the scientific administrator on page 766 in the article of reference and directly in the previous article on the ONR Physics Branch Program [*Science* **118**, 227 (1953)].

UNESCO is at present considering the legal aspects of the problem [*UNESCO Copyright Bull.* **6**, No. 2 (1953)], and the American position seems to follow the older policy adopted in response to League of Nations inquiries in 1928. Rexworthy apparently approves of the UNESCO action to consider protection of "scientific property." I do not state my position since it would be only a value judgment.

All the arguments, pro and con, concerning invention and the patent system could quite nicely be applied to the analogous problem of discovery and legal protection of scientific "property." This is as far as I am willing to go, as I indicated in the concluding paragraph of the paper on scientific property.

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Need for a Standardized International Glossary of Terms in Botany

The formulation of the international rules of botanical nomenclature has been a landmark in the development of systematic botany and has cleared a lot of confusion from that field. There is, however, an equally great need of unanimity and exactitude in the definitions of descriptive terms in systematics and other branches of the subject. After all, what subject can claim to be a science without even having a precise terminology?

At present, various authors define a particular term in widely divergent ways and sometimes even give almost contrary definitions. The confusion prevailing in the terminology of inflorescences and placentations has already been discussed in detail by Rickett (*1*) and Puri (*2*), respectively. Rickett (*3*) has recently drawn attention, in what appears to be the first of a series of detailed articles on the topic, to the existence of a similar situation with regard to many other descriptive technical terms. But such confusions are not limited to these topics alone. Examples can be quoted from various fields and in any number. A few glaring random samples are cited in the following paragraphs.

The term *spike* is used for the strobilus of *Selaginella,* the fertile segment in *Ophioglossum* and other Ophioglossaceae and also for inflorescences of angiosperms. The misuse of the term *panicle* is too well known to be discussed here.

The term *bract* refers to such diverse objects as the sterile lobe of a sporophyll in Sphenophyllales, the sterile structures forming a whorl between the sporophylls in Equisetales, the scale subtending the so-called "ovuliferous scale" in the conifers [Florin (*4*) suggests an altogether different terminology for these structures], the leaves surrounding the fertile structures in the strobili of the Bennettitales, the leaflike structures around the perianth in *Nigella* [which are referred to as an "involucre of 5 leaves" by Willis (*5,* p. 450) and an "involucre of bracts" by Rendle (*6,* p. 141)]. Johnson (*7,* p. 705) defines a bract as a "much reduced leaf, as in an inflorescence or rhizome," while Willis (*5,* p. 92) regards it as "the leaf in whose axil a flower arises."

The term *flower* itself is much abused, being restricted by some to the fructifications of angiosperms and widely applied by others to those of the gymnosperms, for example, to Bennettitales, Cordaitales, Coniferales, Gnetales, and even to the strobili of pteridophytes like *Selaginella* (*8*).

The same type or even the same sepaloid, petaloid, differentiated or undifferentiated structures are called, at different places, *perianth, sepals,* or *petals* by the same or different authors. Most authors restrict the term *syngenesious* to such anthers as those of the Compositae and call the anthers of *Solanum connivant* (*7,* p. 531; *9,* p. 694) or *connate*; others call even those of *Solanum syngenesious* (*10,* p. 360). Similarly the staminal tube in some Malvaceae, for instance, *Hibiscus,* is refererd to as *adnate* or *joined* or *attached* to the petals (*9,* p. 592; *5,* p. 406; *6,* p. 249), although Rendle (*6*) at the same time records that the staminal tube is "considered to have arisen by the multiplication of five epipetalous members." Identical types of perigynous flowers are designated as having *half-inferior, sub-inferior* (*9,* p. 79) or *intermediate* (*5,* p. 477) ovaries by some, while others call such ovaries *superior* (*7,* pp. 63, 296; *11,* p. 179; *10,* p. 249).

There is also no uniformity in the use of symbols in floral formulas. Most authors denote perianth, calyx, corolla, androeceum, and gynoeceum by the letters P, K, C, A, and G, respectively. But Swingle (*12*) and Pool (*13*) use the symbols Ca, Co, S, and P for calyx, corolla, androeceum, and gynoeceum, respectively. These latter authors also use a different method of denoting the number of these parts, their cohesion or adnation, or their superior or inferior character in relation to the ovary, and so on. Many authors indicate by a plus (+) sign at one time an additional whorl, and at other times bundles in the same whorl.