specific nature. To speak of them as 'determiners' is to make use of a convenient figure of speech; but this need imply no more than that they are differentials by the use of which we are enabled accurately to analyze the observed results'' (p. 1113). To take this concept to its logical conclusion has a radical effect upon biological theory, as the writer has shown in a series of papers on the causes of color patterns. It is preferable to use the term ''inhibitor'' rather than ''modifier,'' since the latter has a more restricted meaning in genetics, and extend to the whole of genetics the concept of inhibiting factors which is used to explain melanin pigment inhibition in animals. The concept of hereditary factors as inhibitors is not generally used by plant geneticists, though the evidence is in its favor. Thus, the chromosome-borne inhibitors in albino plants are quite obviously responsible for the inhibition of plastid development, which may be complete as in white plants, or incomplete inhibition as in yellow plants, with still less inhibition for red-colored plastids (chromoplasts). Since flower color is caused by sap pigments produced by plastids, or chromoplasts, or both, then the inhibiting factor hypothesis has only to be extended to include the selective inhibition of one or more of the three primary pigments produced by the plastids, namely, red, yellow, and blue, or incomplete inhibition of the plastids themselves, together with a time variable when the inhibitors become effective, to account for color patterns. In animals there is no evidence that chromosome-borne factors are responsible for melanin pigment synthesis but only its partial or complete inhibition, the variegated patterns being caused by the time when the inhibiting substances appear in early or fetal life. The evidence points to black color as being the uninhibited expression of melanin pigmentation, and hence the conventional multiple allelic series in rodents is each reduced by one, namely, normal black color. Thus, the agouti series in rabbits has only two members, agouti or wild-type, and black-and-tan, normal black color occurring in the absence of these inhibitors provided no others are present.

The inhibitors arise spontaneously, as evidenced by mutations, and range from the dominant, gross type to those of the modifying or regulatory class, the latter being responsible for the nongenetically fixable grades of white spotting and size. The breeding methods of inbreeding, outcrossing, and selection are used for the purpose of attempting to fix the desired types of inhibitors and purge the organism of unnecessary ones. Thus, inbreeding maize purges the plant of some inhibitors but renders others homozygous. The crossing of two inbred strains which are homozygous for a maximum number of different inhibitors will yield the most vigorous hybrids. If the inhibitors could be destroyed, especially selectively, the breeding methods would be simplified. Submitting organisms to X-rays merely increases the number of harmful inhibitors or produces lethal effects through chromosome breakages. However, the inhibiting substances produced by the inhibitors can be neutralized in many cases. An extreme example is seen in the use of plant hormones as herbicides which seem to neutralize cellular inhibiting substances to the extent that the plant grows itself out.

The implication of the inhibiting factor hypothesis is that growth is an inherent characteristic and the chromosome-borne factors merely inhibit metabolism in varying degrees. In other words, under optimum conditions of temperature, light, and nutrition and with a minimum of internal inhibitions caused by chromosome-borne inhibitors, together with an absence of toxic products of metabolism or the neutralization of such, cell growth would be at its maximum rate, and differentiation would not occur. This view has some support from tissue-culture experiments. It is also supported on evolutionary grounds. Thus, the first spontaneously originated compound to form organic matter must have had the constitutional characteristic for its own duplication and hence growth; it could not have acquired this characteristic, as it could not have survived to do so. What would be necessary would be a breaking up of the organic mass to prevent it from becoming a victim of its own toxic products of metabolism. The spontaneous origin of inhibitors would provide the necessary mechanism, since inhibitors have the characteristic of repulsion after duplication, as is evident in mitosis and by inference also in single-celled organisms. Evidence that complex molecular entities duplicate themselves is seen, in addition to the chromosome-borne inhibitors, in plastids and virus molecules, all of which require the specific organization of the cell to do so.

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Are Scientists Irresponsibles?

The leading article, ''Can we curb the irresponsibles?,'' by Lawrence K. Frank (*Science*, 1946, **103**, 349–351), deals with a most important matter on which clear thinking is eminently desirable, but after reading it three times, I find myself much confused. Perhaps I am unduly obtuse, but I need clarification of Dr. Frank's position.

I wholly agree that responsibility for aggression must be brought home to the guilty individuals and adequate punishment inflicted on them, and that the Nürnberg trial is, therefore, fully justified and is based on principles which must be maintained if we are to hope for lasting peace.

But Dr. Frank seems to proceed from this sound basis to the propositions that scientists, by working on atomic bombs are guilty of aggression and may be held liable to punishment, and that an association of scientists may be able by their own action to relegate the atomic bomb to extinction. I cannot follow him on either of these points.

Surely there is a clear distinction between contributing to our military power and using that power for aggression. The scientific work which produced the atomic bomb differed not in character but only in effectiveness from other scientific work which contributed to the development of faster fighting planes, more powerful bombers, air-borne radar for strategic bombing, proximity fuses, and the innumerable other new weapons of the most technological of wars. In that war, in which we were the victims of aggression, it was the obvious duty of every scientist to give our armed forces all the help he could. Now that the war is ended, but firm peace not yet achieved, it remains the duty of every good citizen, including the scientist, to do what is needful to maintain our national strength in order that we may lead in the firm establishment of a strong international organization. Should our Government misuse that strength to start an aggressive war, the scientist, like all other citizens, no more and no less, would share in the guilt if he acquiesced.

As for the second point, while we all earnestly hope that never again will an atomic bomb be dropped on human beings, the only insurance against it is the creation of an international organization strong enough to outlaw the use by any nation of the atomic bomb and other weapons for mass slaughter, to enforce its law by adequate policing, and to inflict individual punishment for infractions. No voluntary association of scientists can exercise such governmental powers. It seems to me unfortunate to deflect attention from the only true remedy by raising hopes in a measure which is certain to prove inadequate.

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Book Reviews

Chemical crystallography: an introduction to optical and X-ray methods. C. W. Bunn. Oxford, Engl.: Clarendon Press, 1945. Pp. xii + 422. (Illustrated.) $7.50.

The author's purpose, as stated in the Preface, is to present a practical guide to optical and X-ray methods for the identification of solid substances and for the determination of atomic configurations in crystals. His treatment of the subjects is designed primarily to introduce the chemist to these techniques and to provide him with a sufficient background to enable him to begin to apply the principles. In accomplishing his purpose, the author has been highly successful. The success is due, in great measure, to the simplicity of the presentation. Mathematics, for instance, has been kept to a minimum consistent with a thorough understanding of the practical applications of crystallography.

The subject matter is divided into two sections. The first, dealing with identification, is concerned with the use of morphological characteristics, indices of refraction, and X-ray powder patterns in chemical analysis. Elementary crystal theory, including symmetry, nomenclature of planes, growth features, etc., is clearly presented. The meaning of the refractive indices and their measurement and use in identification are particularly well developed.