green peach aphid, *Myzus persicae* (Sulzer) could transmit the virus of peach mosaic disease. Carefully controlled experiments carried out in 1943 and 1944 under greenhouse conditions have confirmed the results obtained in the field and prove the ability of this insect to transmit the virus of peach mosaic.

Peach seedlings grown from Georgia native pits under insectproof cages in the greenhouse were used as test trees. These seedlings have never shown symptoms except when vegetatively inoculated.

Cultures of the green peach aphid were taken from peach trees growing in the orchard and maintained throughout the year on plantings of potatoes. Both viviparous apterous and alate forms were used after they had fed for varying periods on the flowers and foliage of diseased peach twigs. In transferring the insects, infested flowers and foliage were cut from a diseased twig and suspended in the top of the test seedling, to which the aphids migrated. Aphids were confined during the feeding periods on infected twigs and on test seedlings in closed glass chambers. The number of aphids and the length of time on the test tree have varied. Eighteen trees out of twenty-five tests have shown symptoms of peach mosaic. Check seedlings of the same age and grown under the same conditions have remained healthy. Under greenhouse conditions the symptoms have tended to be mild; consequently, each test has been followed through at least one period of dormancy and further verified by bark grafting into uninfected seedlings and into June budded Elberta trees. Typical symptoms were produced by these bark grafts. In one of the first cases of successful insect transmission under greenhouse conditions five bark grafts into healthy seedlings produced five typical cases of mosaic in a period of 20 days.

It is not known whether *Myzus persicae* is the only insect that spreads peach mosaic in Colorado. Several other insects more or less common in the peach orchards of the state have been tested, but failed to transmit the virus of this disease.

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ANAEROBIC RESPIRATION

THE expression "anaerobic respiration" appeared in an article recently wherein the apparent anaerobic metabolism of a slime mold was described. The article brought forth some kindly and paternal advice from younger physiological chemists, one of whom asked, "Don't you mean fermentation?" Another wrote: "The expression 'anaerobic respiration' is rather startling to a manometrician; even botanists are giving it up. I think it wisest to drop the term and speak of carbon dioxide evolution in all cases, and of fermentation or glycolysis where these apply." That anaerobic respiration should be referred to as fermentation is rather generally held by the new school of physiological chemists who classify organisms as (1) aerobes possessing only oxygen-consuming metabolic systems, (2) strict anaerobes possessing only anaerobic fermentative metabolic systems and (3) facultative organisms possessing both oxygen-consuming and fermentative systems. I accepted the above criticism without comment until there was added the remark that I "as a botanist might get away with the expression." Then I began to wonder whether botanists were "getting away with" a time-honored biological concept, or physiological chemists were "getting away with" a narrow chemical point of view.

What first impressed me as extraordinary was the fact that the broad biological view of respiration was being narrowed down by physiologists, whereas the concept of oxidation was being broadened by the chemists. Thus, although certain physiologists now insist that respiration must involve molecular oxygen, chemists say that oxidation need not involve oxygen at all.

The confusion has arisen because of a redefining of respiration by the new school of physiological chemists. Instead of viewing respiration as a concept, as a complex reaction in living matter whereby energy is liberated, without reference to oxygen or the lack of it, physiological chemists make their own definition, one restricted to a reaction involving molecular oxygen. The biological concept is not only the broader one, but it is the historical one.

Pedantic fealty to definitions pervades, and retards, all branches of thought. Definitions are a necessity. We need them as students in order to understand a new language, but the better we know the language the less need we have for definitions.

Let us accept, for a moment, the definition point of view and see whether or not respiration or fermentation has until now been defined on the basis of oxygen consumption. The biologist regards respiration as that reaction or series of reactions in living matter whereby energy is released for the maintenance of life. E. C. Miller[1] defines respiration as any reaction in which there is a liberation of stored energy in cells; if without oxygen it is anaerobic respiration. Lundegardh[2] views the matter in the broad biological sense when he states that the aerobic process predominates in natural life; anaerobic respiration is a relief when aerobic life is temporarily checked.

The concept "fermentation" was likewise not put on an oxygen or non-oxygen basis. None of the earlier definitions includes or excludes oxygen. Fur-

[1] E. C. Miller, *Plant Physiology*, 1931.
[2] H. Lundegardh, *Ann. Agr. College, Sweden*, 8: 233, 1940.

thermore, bacteriologists not only make common use of the expression "anaerobic respiration," but they speak of "acetic acid fermentation" in which free oxygen is involved.

Respiration may be defined as any oxidative process in living matter which releases energy. In this case we are forced to accept the chemists' definition of oxidation, namely, "The withdrawal of electrons from a substance, with or without the addition of oxygen, or the withdrawal of electrons, with or without the withdrawal of hydrogen or elements analogous to hydrogen." Thus, whether respiration is viewed in the broader sense of a biological concept, or the narrow sense of a specific chemical reaction, the end is the same, oxygen need not be involved.

I believe that I express the consensus of opinion when I say that plant physiologists do not think it necessary or wise to substitute the term fermentation for anaerobic respiration. I believe, also, that I express the point of view of the majority of medical physiologists when I say that respiration should be used as a general term for all biological, energy-yielding reactions. The bacteriologists are of the same opinion; they regard respiration as referring primarily to energy relations, and fermentation as indicative of end products formed and substrates acted upon.

Several changes could be made. The term respiration could be dropped and reference made only to energy exchange. Or, the expression "internal respiration" could replace "anaerobic respiration." Of all possible changes, the least scientific is the substitution of fermentation for anaerobic respiration. But why make any change? Why not broaden the meaning of respiration, just as the chemists did that of oxidation when they found the need for doing so?

There is no objection to retaining fermentation to indicate certain anaerobic reactions, but when these reactions are substitutes for energy-yielding aerobic processes, they become anaerobic forms of respiration.

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BASIS FOR SCIENTIFIC TERMINOLOGY AND CLASSIFICATION

THE formulation of the following remarks was catalyzed by the article by Dr. Fox on "Biochromes," appearing in SCIENCE for November 24, 1944. I wish to make it quite clear at the outset that the following matter is intended as constructive criticism of principle designed for stimulation of discussion; it is not intended as an individual criticism of the specific content of the above article.

It is proposed by Dr. Fox that a certain group of substances be designated by a certain label on the basis of two facts—(1) their occurrence in living matter and (2) their possession of color, *i.e.*, selective absorption of parts of the visible spectrum. Certainly the name selected (biochromes) is well chosen for this particular purpose. Let us examine, however, the basic principle underlying the "excuse" for increasing the technical vocabulary. The mere existence of a certain group of substances only in living matter, as far as we know to-day, seems hardly enough of a justification for setting them apart under a new class-name; the possession of color is even less of a reason for so doing. The entire problem of color and light absorption is too large a subject for an offhand discussion; however, setting apart a group of substances merely because their selective absorption happens to fall into that region of the spectrum which is perceptible to the human eye and without apparent consideration to their structure and function types seems to be a fallacy. This is especially true when one considers that an increasingly greater part of our observations of matter is being done with the aid of the extra-visible regions of the spectrum, *i.e.*, photographic and instrumental observation and recording of ultra-violet and infra-red regions. If we continue to succumb to the temptation of designating and classifying the world around us merely on the basis of our five human senses, the systematization of science will be in a very sorry state indeed. Consider for a moment the possible appearance of the "Beilstein" based on this theory. The result makes me shudder.

The whole matter can be considered logically only if one considers the principles underlying scientific terminology and vocabulary. It is readily seen, I believe, that the classificational function of any science (referring, of course, only to the "exact" sciences) is a function subordinate to the investigational and creative function. The former can be held to be no more than a useful or usable tool for the latter. It is difficult to imagine the circumstances under which the former function can, per se, cause any significant advance of our knowledge of the world around us. It can be hardly denied that the latter statement covers the true aim of any scientific pursuit. Granted this thesis, it is readily seen that the classification and nomenclature must be so designed as to be truly useful, simple and durable. Much can be said about the first two conditions. I prefer to stress the last one. In the past century there have been all too many occasions for complete overhauling of classification and designation systems in almost all branches of science. Regrettably, in some branches it has not been done. In others, the changes were frequently made only to require revisions almost upon birth. The main reason for this has been the rather