The first volume of these transactions makes interesting reading to-day. It shows that one of the most active pioneer members, besides the philologist, John Wallis, was Mr. Robert Boyle, who in his letters refers to himself as also a member of the "invisible college," probably the Rosicrucian offshoot of the New Philosophy, composed originally of scientific men bound together as an esoteric sodality without name or meeting place and having for its sole end the alleviation of the physical and spiritual ills of humanity.

It seems that at first Sir Isaac Newton held somewhat aloof from the infant Royal Society. They appear, however, to have felt that they could not get along without him, and in January, 1671 (O. S.), he was elected a fellow and accepted the honor.

But difficulties soon arose with the secretary, Oldenburg, in connection, apparently, with some disposition to criticize Newton's new theory of light. On the 8th of March, 1673, Sir Isaac writes a tart note to the secretary saying that he desires "to be put out from being any longer fellow of the Royal Society" on the ground that "the connection is not profitable to either party."

The society then offered to excuse him from paying his dues, a proffer which Sir Isaac, in his reply to the letter announcing the action, affects to consider immaterial.

In 1675 the matter seems to have been satisfactorily adjusted and Newton is reenrolled as a fellow. But evidently peace did not last long, and the controversy over his theory of light did not subside; for in 1676 he writes to the secretary saying that 'he will resolutely bid adieu to philosophy eternally, excepting what he does for his private satisfaction or leaves for publication after his death; for he sees that a man must either resolve to publish nothing new, or spend his whole life in defending his hypothesis.'

Fortunately for the world, he later revoked his decision and from 1703 to his death was president of the organization which published his *Principia*.

I have dwelt on these excerpts from the early minutes of the Royal Society because they are so eloquent of the personal equations involved in bringing scientific men together for what Bacon calls "intelligence mutual, contract, fraternity, and conjunction of labors."

The subsequent history of the Royal Society and later similar organizations like our own is in large part the history of the "proficience and advancement of learning," and I hope our brief computation of antiquity forwards will have made evident that in one sense we are this afternoon really celebrating the 300th birthday of the "able and sufficient" parent of the American Association for the Advancement of Science.

Purdue University Mark H. Liddell

THE TERMINOLOGY OF CERTAIN PHYSICAL AND BIOLOGICAL EFFECTS OF LIGHT

In any discussion of the nomenclature of matters pertaining to light one must first make clear what he means by the term light. For there are several definitions extant in illuminating engineering and other literature. In the present case I shall define light as electromagnetic radiation of such wavelength that it may effect adequate stimulation of the sense of sight.[1] Or, light is photic radiation, where photic means effective in producing the sensation of brightness contrast. In this definition light has an objective reality, as all measurable things in physics have. To bring out clearly what the present usage[2] of the term radiation is and how the above definition of light is related thereto I am giving the chart of Fig. 1.

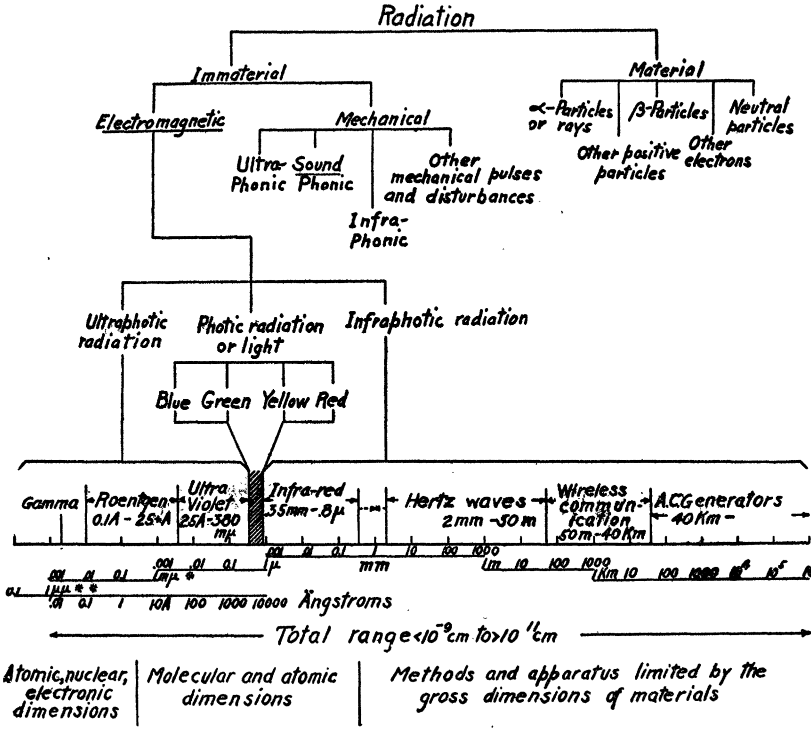
When one surveys the effects of light he finds that there is a considerable confusion of terminology, leading in some cases to an actual confusion of the phenomena. This results in some instances from a lack of short connotative words. The purpose of this note is to point out how a few of these shortcomings in nomenclature may be rectified. For example, the term phototropy has a meaning in zoology different from that in physics. In fact, this word has two different meanings in each of these two sciences. The word photolysis has had a meaning in botany different from that in chemistry.

To make certain suggestions regarding this matter clear and yet succinct, the chart of Fig. 2 is given. Here the various effects of radiation are enumerated and the effects of light are there also as effects of radiation of particular wavelengths. The gross classification into the physical, the chemical and the biological is conventional, having practical but no logical significance. When more shall have been learned about the effects, a better classification no doubt may be had by ignoring this convention. It must be obvious to every one that such a classification has always fringes where the subject-matter may not be clearly demarcated. Some effects are indicated under more than one class, and many others might have been or will be probably as data are accumulated.

The first items for consideration as new suggestions are the terms describing the electrical effects. The phenomenon referred to sometimes as the electromotive force due to light I have termed photovoltic. Certain substances like silver sulphide will, when made a part of a metal circuit, exhibit a difference of potential between illuminated and unilluminated

[1] For other definitions of light see Trans. I. E. S. 1918 and 1922. For a discussion of the definition given above see J. Fr. Inst., 1923.

[2] This matter will be discussed in greater detail in another paper.



* Frequently, especially in older literature μμ

** Sometimes ψμ, recently.

FIG. 1 Chart showing what the concept radiation implies and how the concept light is related to it

portions. Many solutions into which electrodes are immersed will do this, notably cuprous oxide in saline solutions, when one electrode is illuminated. The term photovoltic has obvious advantages over other more lengthy phrases or terms. It will not be confused with the word photovoltaic that has been used (but very infrequently) to denote a change of resistance of selenium when illuminated. For this last effect the term photohmic is reserved. In these two cases at least we find that the use of the name of the unit of resistance and of the unit of potential results in short euphonic and connotative words; and one is inclined to press this method of word formation to other cases. For instance, a change in inductive capacity due to light may be referred to as a photohenric effect. Here we may actually avoid a possible confusion with the phenomenon of the induction period in photochemistry, although the term may not pass as euphonic as the two above.

The ordinary Hallwacks effect (emission of electrons from illuminated metals) is usually called the photoelectric effect, although it might more appropriately be called the photoelectronic effect. Yet the term photoelectric having been so commonly used will cause no confusion if it be allowed that the term photoelectrical have a more general meaning, as indicated in the chart. Certainly, a term of quite general meaning is desirable here. Other effects named in the chart as photoelectrical are self-explanatory; such as photoionic (*e.g.*, in gases), and magnetic induction. The latter refers to such effects as are taken advantage of in radio communication and do not interest us from the standpoint of light. The precipitation of colloids by light is due to the formation of charged particles so that one may wish to insert it elsewhere.

For completeness the photo-magnetic effects now appearing in the literature should be inserted under the electrical group.

Under the optical effects photallochromy is suggested as a substitute for phototropy. What has actually been classified as phototropic heretofore are effects due to light which change the physical state of a body such as to cause the body to appear of different color. Now a body may be changed physically without a change of color, and there are other ways in which such changes may be detected. The allotropic changes and color changes may have no relation to each other and the nomenclature should differentiate between the two sets of effects. Examples of allotropic changes due to light are the change of yellow into red phosphorus, oxygen into ozone, soluble into insoluble sulphur.

To take cognizance of the color changes which

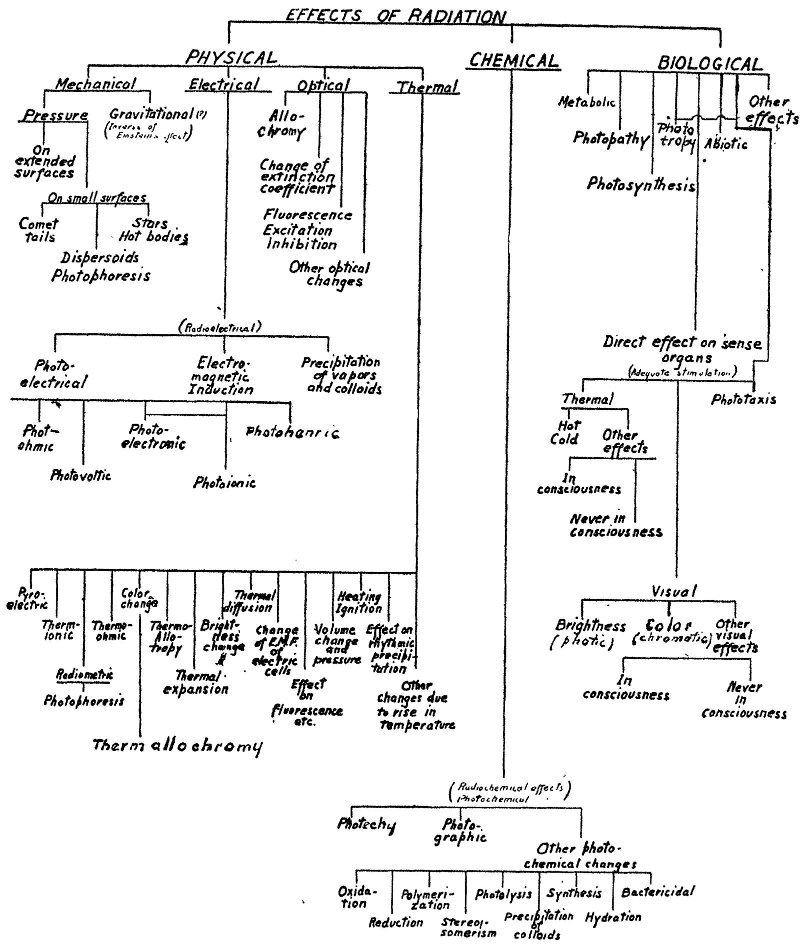


FIG. 2. Chart of effects of radiation

bodies and substances undergo when subjected to different environments the term allochromy is suggested. Accordingly photallochromy (as in phosphorus) is under optical, while thermallochromy (mercuric iodide) lies under thermal effects. Incidentally, this term lends itself well to all such other changes of color as are caused by crushing (piezzallochromy), and even by chemical reactions (chemallochromy) or those brought about in organisms (bioallochromy). Photallochromy has recently received considerable attention in connection with the lighting of museums, where the fading of specimens due to light is a serious matter.[3] The general phenomenon of allotropic changes due to radiation is placed under chemical effects.

Most of the new terms under thermal effects will now also be clear. Instead of the term pyroelectric the term pyrovoltic may be used in accordance with the terms suggested and discussed under electrical effects.

Under the chemical effects no suggestions are offered. For a most excellent detailed classification here reference may be made to Plotnikow in his "Lehrbuch der Photochemie."

Certain points for discussion arise in connection with the biological group. The word phototropy may be retained here since it has been entirely deleted from the physical and chemical groups. Yet with its duplicity of meaning in zoology it might be questioned whether or not it is retainable with clarity to designate one specific phenomenon as the botanists have it, and whether it had not rather be relegated to the indefinite and popular usage where its various meanings may be retained without serious consequences. Botanists and zoologists recognize a large number of reactions known as tropism. These are described by various affixes as rheo, geo, photo, rheostich,[4] chemo and others. It may be convenient

[3] Ill. Engr. (London) 15, p. 308, 1923.

[4] The word rheostichotropism (stream, line, adjustment) was coined to designate the structural adjustment in organism toward streamline contours. See Jour. Franklin Inst. p. 737, 1923. Inadvertently the middle root was deleted in the galley proof and the word ap-

therefore (and I wish for the present) to retain the word phototropy in its most usual botanical sense.

In this sense phototropy refers specifically to the orientation by organisms in response to an intensity gradient. There is another set of reactions closely related to the phototropic, known as phototactic, in which preference is shown for light of either greater or less intensity without immediate reference to orientation. It is aside the present purpose to discuss the relationship between the two. The two kinds of phototactic reactions, according as the preference is for and the movement into regions of greater or less intensity, may be referred to as photophilic and photophobic, respectively. The two phototropic reactions may be distinguished by the prefixes dia and para according as the orientation is such as to allow a maximum or minimum of radiation to be *effectively* absorbed.

In botany there are other photic effects which I have not enumerated; such as phototonic, photoclistogamic, photoauxesis, photoperiodism, photolysis, and certain others which upon close inspection may possibly be classified—as particular aspects of phototropism or some other effect. These bring along no inconsistencies—only for the term photolysis it is suggested that the meaning given by the chemist be the recognized one (*viz.*, dissolution or solution of cells or substances).

I am suggesting the use of the term photopathy in a rather general sense and with a connotation that is suggested by the root *pathos* when used in such a word as pathology. Photopathy then includes such effects as photomania, photalgia, photerythema, photoncia (swelling), photoptarmosis (sneezing). An independent position should perhaps be given in the chart to photomorphosis or photomorphism for the structural effects in organisms due to light.

Through this note I hope that an impetus may have been given to those who are interested in the various effects of radiation, and of light—photochemical, photophysical and photobiological—to give some attention to certain matters of nomenclature that may result in clarity and unity of usage in the widely separated branches of science. It is hardly to be expected that my first suggestions given above on such matters of nomenclature will be equally satisfactory to the botanist, the zoologist, the chemist and the physicist, and shall we say, the pathologist or the phototherapist.

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pears as rheotropism which has already a well established meaning in zoology different from that intended here. A more desirable word it now seems to me is *rheomorphism*.

THOMAS CORWIN MENDENHALL

T. C. MENDENHALL, as he always signed himself, had a special talent as an educator, a valuable and rather rare gift, and with this he had a strong interest in scientific knowledge, and tireless energy in seeking it. Without the advantage of a college education himself, his ability and industry were such that at the age of 32 he was the first member elected to the first faculty when what is now the Ohio State University was founded in 1873. His steadfast devotion to education is shown by the fact that just 50 years later, when living in retirement, he was selected as the president of the board of trustees of this same university, and he was serving actively in this capacity at the time of his death on March 22 last at Ravenna, Ohio. He was born in the neighboring town of Hanoverton, October 4, 1841, and thus lived to the good age of over 82 years.

Dr. Mendenhall's success in educational work was due to clearness of expression and aptness of illustration, charm of manner and interest in men, as well as in his love of knowledge and of making it useful to others. After preliminary training as a teacher, he became the first professor of physics in the Ohio State University, and served in this capacity for five years. At this time scientific education in the United States was in an early stage and Dr. Mendenhall exerted an important influence in its development in the middle west. He refers to the period as one "when those engaged in scientific research even for a very small portion of their time were but a handful." An associate of those days writes "he was full to overflowing with the purpose to do his share in giving to science study its deserved place in public schools and placing it upon the proper plane in colleges." When Japan determined to develop a great university at Tokyo she called for help from England and America, and Professor Mendenhall was one of a group of able men invited. He went to Japan in 1878 as professor of physics in the Imperial University, and remained three years. He then returned to the Ohio University. Later, after service with the government, he was president for several years of the then recently organized Rose Polytechnic Institute, and again after another term of public duty, he was president for seven years of the Worcester Polytechnic Institute, from which he retired in 1901. Thus in the educational field he organized the departments of physics in two universities, was president of two engineering colleges, and closed his career as a trustee of his state university. His students remember his clear exposition, his kindly interest and his helpful practical advice; his stimulating influence affected the future of many men. When Dr. Mendenhall retired from the Rose