carry goods as determined by the Shipping Board.

The Shipping Board also exercises the control of interstate commerce by water, its powers being analogous for water transportation to those which have been exercised by the Interstate Commerce Commission in regard to railroads. However, the powers of the Shipping Board extend beyond those of the Interstate Commerce Commission in that the board is allowed to approve any agreement between common carriers by water concerning rates, accommodations, pooling, limited sailings, and other arrangements; and all agreements thus approved by the board are exempt from the Sherman antitrust law and its amendments.

Under the Shipping Board, there has been organized the Emergency Fleet Corporation with a capital stock of $50,000,000. This corporation has requisitioned all the shipyards of the United States and all the ships under construction. The ships will be completed in accordance with the directions of the Fleet Corporation. The actual operation of the yards and the finishing of the ships remain with the corporations and persons who previously had them in charge, but the compensation which they are to receive is upon the basis of a fair profit, which is decided by the Fleet Corporation.

The Fleet Corporation is also engaged on a gigantic scale in the construction of additional ship-building plants and in the construction of new ships. This work is largely done not by the Fleet Corporation itself, but under contract. The Emergency Fleet Corporation has announced that the actual building program under contract embraces more than 8,000,000 tons, dead weight capacity.

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(To be continued)

THE NOMENCLATURE USED IN COLLOID CHEMISTRY. A PLEA FOR REFORM

Colloid chemistry is no longer considered as a mere collection of mysterious substances and "abnormal" reactions. It is an important branch of chemical and physical science possessing a fairly well established working basis and is rapidly acquiring new students.

It suffers, however, like all virgin sciences, the affliction of superfluity of terms used to describe essentially the same things, careless and loose use of some expressions, and confusion of nomenclature in general. This condition results in a great handicap to new students. It is very difficult for them to acquire clear conceptions from their first readings of the various works on the subject.

It is time that this matter be taken in hand by some committee of our Chemical Society for the purpose of removing this needless handicap and confusion by defining the various terms used in colloid science, eliminating unnecessary ones and by standardization of the terminology in general, just as was done with the terminology of the proteins by the biological chemists some years ago.

The paragraphs which follow attempt to point out some of the cases of malusage of terms.

No objection can be raised against the word "colloid." It is distinctive, but the use of the expression "colloidal *solution*" is to be strongly condemned, since it is so evident that substances in the colloidal condition are not dissolved, in the strict sense of the term. Colloidal particles are in a condition midway between solution and mechanical suspension, and they are held in this peculiar state of *dispersion* by virtue of their surface energy, electrical charge, their kinetic energy as manifested by the Brownian movement, and the adsorbed ions of electrolytes which are essential to the stability of all colloids.

The general term "dispersion," as suggested by Wo. Ostwald, is to be preferred to the special term "solution." *E.g.*,

"Mechanical suspensions" are	Coarse dispersions,

"Colloidal solutions"
are Colloidal dispersions,
and
"True solutions" are Molecular dispersions.

The particles, or "internal phase" of these systems are known as the "dispersed phase," and the liquid in which they are dispersed, the external phase, is known as the "dispersion medium."

The present usage of the word "sol" and of its modifications—"hydrosol," "alcosol," etc., to describe a colloidal dispersion, is the same as that of Graham, their originator. I have noticed, however, that the word "sol" has been used by a few writers in the sense of the dispersed phase, *i. e.*, the particles in colloidal dispersion. Is this use of the term to be permitted? Graham invented it as a short and convenient substitute for colloidal "solution" and a perusal of the works by Bechhold, Cassuto, Freundlich, Hatchek, Ostwald, Taylor and Zsigmondy shows that the original sense of the expression has been retained by these writers.

The use of the term "gel," however, and of its modifications, "hydrogel," "alcogel," etc., is deplorably loose and confusing. This term was coined by Graham[1] and first used by him in discussing the "pectization" or coagulation of the hydrosol of silicic acid. Therefore, if we are to limit the use of "gel" to its original sense, we should use it only when speaking of the definite *coagula* of sols. This is not the case, however. Any substance which resembles a jelly in appearance is called "gel," although in chemical and physical properties it may be entirely different from the kind of matter which Graham had in mind when he invented the term. This use of the expression is exceedingly popular and would be very difficult to overcome.

Let us take up a case or two to show how unscientific this latter usage of the term is. For example, consider the dissolution or dispersion of gelatine in hot water. It forms a very mobile "solution" or rather dispersion, and in this form is called a hydrosol or sol. If this hydrosol be allowed to cool, it becomes very viscous and "sets" to a jelly-like mass. In this stiffened form it is popularly known as a "hydrogel" or "gel." If it be warmed again, its viscosity decreases, it becomes mobile and is called a "sol." Now if this use of the term "gel" (which is not as Graham intended) is to be permitted, then what is the line of demarcation between the sol and gel states? A change in state has occurred, it is true, for in the sol condition the water was the external phase whereas in the so-called gel state the gelatine became the external phase and the water internal. The change is very gradual, however, and our change of terms to suit the change in appearance of the system is exceedingly arbitrary and unscientific. Furthermore no chemical change in the nature of the gelatine has taken place.

If some alum or a trace of mercuric chloride be added to the gelatine hydrosol, a coagulum is obtained which is correctly termed a gel according to Graham. This is a coagulated compound, however, a chemical reaction has taken place. It will not redissolve in water and is, therefore, entirely different from the case discussed above, which is also commonly called gel.

To further complicate matters, the dry pieces of gelatine (and in fact any other colloid which will "dissolve" readily) which were used to make the original sol are also quite commonly called "gel." Lottermoser called attention to this several years ago and suggested that such pieces of gelatine, or of any other dry "soluble" colloid be called "solid sol." This suggestion is obviously bad. Why apply any special term at all?

When a hydrous ferric oxide sol is allowed to evaporate spontaneously, it will go through a jelly-like stage and finally become a hard scaly residue when all or nearly all of the water has left it. The jelly-like form will redisperse when warmed with an excess of water, while the amorphous form will not. Yet both forms are called "gel"! Zsigmondy distingishes between these two different forms by calling the first one "hydrogel" and the second, "gel."

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[1] *Proc. Roy. Soc.*, 13, 337 (1864).

A review of the texts on colloidal chemistry shows the following conceptions of this term.

Cassuto[2] calls a gel the gelatinous precipitate obtained from a sol by means of an electrolyte, heat or evaporation. *I. e.,* a gel is formed by coagulation of a sol. He calls stiffened sols (or jellies), "gelatines."

Bechhold[3] remarks the loose use of the word "gel" and states that he restricts it to the description of the coagula from sols. To the stiffened sols or jellies he applies the term "Gallerte," which in English might be called "jelly."

Freundlich[4] says that systems of solid dispersion media and liquid dispersed phase are gels as distinguished from the reverse which are suspensions or emulsions. In other words he applies the word "gel" to jellies.

Hatschek[5] refers to the fact that Graham applied the name "gels" to the products obtained by the coagulation of sols, but later on in his book he calls jellies, gels also.

Ostwald in his "Handbook of Colloid Chemistry," considers all colloids as gels when the system becomes "microscopically heterogeneous." That is to say, he applies the term promiscuously.

Taylor[6] uses "gel" in the same loose general manner as Ostwald, Hatschek and Freundlich.

Zsigmondy in his "Kolloidchemie," limits the word "gel" to the dry residue which will not redisperse in a solvent, but he applies "hydrogel" to the jelly-like mass formed by removal of the dispersion medium or by salt coagulation.

Hardy[7] recognized the difference in properties of substances called "gels" and he qualified the term—"gels by coagulation" and "gels by stiffening."

I feel confident that Graham did not apply this term as loosely as is popular at the present time. In his remarks on the properties of colloidal tungstic acid[8] he says: "It is remarkable that the purified acid is not pectized by acids or salts even at the boiling temperature. Evaporated to dryness, it forms vitreous scales, like gum or gelatine." Note that he describes the dry residue as "scales, like gum or gelatine" and not as gel.

It is evident, then, that the original meaning of the term gel has not been adhered to and in fact is more often applied to the state best described as jellies. Shall we adhere to Graham's definition or shall we discard it, restricting the term gel and its modifications to jellies, as popularity favors, and do away with any special terms to describe coagula from sols by electrolytes, or residues formed by evaporation to dryness? Special terms to describe these last two cases are obviously unnecessary and serve only to encumber colloid chemistry.

Lately the word "peptization" or "peptinization," as originated by Graham, has shown tendencies of wider use than formerly. Graham used this expression to describe the formation of a sol from a gel by the influence of a small amount of foreign reagent as, for example, the formation of a hydrous ferric oxide sol from a coagulum of ferric hydroxide by treatment with a small amount of hydrochloric acid or ferric chloride. He named it "peptization" because it resembled the hydrolysis of egg white to peptone by acid.

Cassuto, Hatschek, von Weimarn and Zsigmondy preserve the original sense of this term. Bancroft[9] has recently proposed, however, that we use peptization to describe all cases of transformation of gel (using this term in the present popular sense) to sol and not restrict it merely to cases where a foreign electrolyte has been added to accomplish the change. *E. g.,* when dry gelatine is "dissolved" in water Bancroft would call it a case of gelatine being peptized by water. This usage has its merits because it eliminates the word "dissolve" and the implication of "solution."

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[2] "Die Kolloide Zustand der Materie."

[3] "Kolloide in Biologie und Medizin."

[4] "Kapillarchemie."

[5] "Introduction to the Physics and Chemistry of Colloids."

[6] "Chemistry of Colloids."

[7] *Z. physik. Chem.,* 33, 326; 385 (1900).

[8] *L. c.,* p. 340.

[9] *J. Phys. Chem.,* 20, 85–117 (1916).

Ostwald defines peptization as the phenomenon opposed to coagulation.

Taylor prefers a new term, "solation," which he applies to all cases of gel → sol transformations, and incidentally he urges the adoption of "gelation" to define all cases of sol → gel transformations instead of coagulation or pectization.

"Pectization," another of Graham's terms, is rapidly dying out. The word "coagulation" covers all cases of pectization and therefore why preserve an unnecessary term? Furthermore, why adopt the new term "gelation" proposed by Taylor. "Coagulation" is adequate. Of course, if it is decided to name jellies (stiffened sols) "gels," then the word "gelation" would be a good one to describe the "setting" of the gel or the stiffening of the sol.

Elimination of some synonymous terms is decidedly necessary from the list of names applied to the two more or less distinct classes or systems of colloid dispersions. For example, these two systems are variously named as follows:

Authors		
Noyes[10]	Colloidal solutions	Colloidal suspensions
Hardy,[11] Zsigmondy[12]	Reversible colloids	Irreversible colloids
Billitzer[13]	Baser colloids	Typical or genuine colloids
?	Hydrophilous colloids	Anhydrophilous colloids
Henri[14]	Stable colloids	Unstable colloids
Perrin, Freundlich,[15] Neumann[16]	Lyophilic colloids	Lyophobic colloids
Bary[17]	Dissolving colloids	Electrical colloids
Wo. Ostwald[18]	Emulsion colloids	Suspension colloids
von Weimarn[19]	Emulsoids	Suspensoids
Burton[20]	Gelatinizing type	Non-gelatinizing type

The terms "emulsoid" and "suspensoid" are very popular. "Lyophilic" and "lyophobic" are very expressive. The "stable-unstable" and the "reversible-irreversible" terms should be abolished, since they describe the conduct and changes in state of colloids when subjected to external conditions and are not always sharply defined. For example, hydrous ferric oxide sol is fairly stable in the presence of neutral electrolyte (much more so than colloidal gold or platinum), while it is irreversible when evaporated to *dryness*. Most writers classify it with the suspensoids, although Taylor calls it an emulsoid (since if it be evaporated *not quite* to dryness it is partially reversible). In reality it belongs to neither of these two generally accepted classes; its properties place it midway between the two, nearer the suspensoid than the emulsoid class. All the hydrous oxides of the basic or acidic elements act similar to hydrous ferric oxide.

On account of this confusion of classification Bancroft[21] has suggested that the distinction between these two groups be done away with. He prefers to classify colloidal systems according as to whether water or the more mobile phase, is the internal or the external phase and states: "While we are reasonably sure that colloidal gold is a solid and that colloidal oil is a liquid, the two behave exactly alike when both are suspended electrically."

This suggestion is along the proper lines, but is too sweeping, since colloidal gold and colloidal oil do not behave alike.

After a consideration of all the terms, it would seem that "lyophilic" and "lyophobic," or their more special derivatives, "hydrophobic" are the least objectionable terms, since most colloids answer to one of these designations. When our knowledge of colloids becomes exact enough to *sharply* differ-

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[10] *J. Am. Chem. Soc.*, 27, 85 (1905).

[11] *Proc. Roy. Soc.*, 66, 95 (1900).

[12] "Kolloidchemie."

[13] *Z. physik. Chem.*, 45, 307 (1903).

[14] *Z. physik. Chem.*, 51, 29 (1905).

[15] "Kapillarchemie."

[16] *Koll. Z.*, 3, 80 (1908).

[17] *J. Chim. Phys.*, 10, 437 (1912).

[18] "Handbook of Colloid Chemistry."

[19] "Grundzüge der Dispersoidchemie."

[20] "Physical Properties of Colloidal Solutions."

[21] *J. Phys. Chem.*, 18, 549–558 (1914).

entiate between these two classes then we may find names for those systems which now seem to have properties which place them in neither of the above.

Before concluding, attention is directed to the irritating, although not very serious, mistake in the translations of the German terms "disperse" and "dispersions Mittel" by some authors. The German adjective "disperse" is "dispersed" in English, not "disperse," and "disperse Phase" is "dispersed phase," while "dispersions Mittel" is "dispersion medium" and not "dispersion means." These mistakes are like the old one of translating "Wanderung der Ionen" "wandering of the ions" instead of "migration of ions."

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ADDRESS AT THE FUNERAL SERVICES OF JOSEPH YOUNG BERGEN

I HAVE known Mr. Bergen for nearly thirty years, and for a considerable time I was intimately associated with him in the authorship of a book, a text-book of physics. He did not begin his scientific work as a physicist; he began it as a chemist, and he did not end it as a physicist; he ended it as a botanist. But these changes in the subject of his labors, like the changes in his place of residence—from the middle west to New England, then to Italy, then back to New England—came from no fickleness of interest or infirmity of purpose. They were the result of certain hard conditions working on a man of extraordinary versatility, of extraordinary capacity, of extraordinary devotion to high ideals.

As a teacher he was not content merely to hold a place; he was receptive, active-minded, original; his alertness of observation, his catholicity of interest, his energy of imagination, enabled him to take the dry, dull matters of daily experience and kindle them into a source of illumination and vivifying power. As a writer of books he was not satisfied to give the public of his readers merely what it wanted. In physics and later in botany he took a large part in a great revolutionary movement affecting the teaching of science in all the secondary schools of this country, so that his name became familiar to all the progressive teachers of physics or teachers of botany throughout the land. And in those other writings, of a less formal character, in which he and Mrs. Bergen cooperated with perfect sympathy, there was a solidity of substance and a quality of form that commanded, I believe, the respect and the approval of profound scholars.

Nor was this all. What a fine, brave thing it was for a man of middle life, with an assured position as a teacher and with little financial assurance elsewhere, to give up this position and go to Italy, in order to pursue his scientific studies in their higher aspect, the aspect of original research, and to give his wife the physical conditions of life which she needed and for which she longed. And how finely, how bravely, he bore the care, the anxiety, the sorrow, that come to all of us in some measure and that came to him, it might seem, almost beyond measure.

With this character and this career, what manner of man did he seem to those who met and talked with him? I remember him vividly as I used to see him twenty-five years ago, the tall, spare, slightly bending figure, the long, swift, gliding stride, the abundant tawny hair and beard, the great brow jutting over the resolute, patient, illuminated face. And what was his manner of conversation? He talked freely and of many things, but not in commonplaces. It was not that he avoided commonplaces; they did not occur to him; he had not a commonplace mind. If one was in the mood to indulge in the ordinary gossip of the day, one was not in condition to sustain worthily a conversation with him.

But on one matter, one great matter, he never, so far as I can now recall, spoke to me. He was the son of a minister, and he once described to me with a certain grimness of humor some of the trials of a minister's family; but of religion, of religious faith or creed, he did not speak. He may have had a feeling, since I was a constant church-goer