who fear that a beautiful building will distract a man from his work. Beautiful architecture has a highly cultural effect; for daily contact with it brings a capacity to criticize the inferior styles and to appreciate the superior. Heaven knows we need such criticism in America! At the same time we must not lose sight of the fact that fine buildings and fine equipment do not make a college. There must be money to pay for brains. Superior men must be obtained and retained at all costs, even if it means that others must lose their jobs; for the service of the true scientist to these young men and women is the all important thing. They will miss an element in their culture which they can never obtain in any other way if they are not brought in contact with keen, productive minds. Science makes no claim to monopoly in the zeal for truth; but it does offer to-day the surest means of eliminating superstition and make-believe which still linger in the college atmosphere, of keeping one's feet on the ground, of gaining confidence in the processes of reason, and thereby strengthening the human spirit.

NOMENCLATURE OF THE HYDROGEN ISOTOPES AND THEIR COMPOUNDS

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THE separation in quantity of the hydrogen isotope of mass 2 has presented some interesting and very important nomenclature problems. The Nomenclature, Spelling and Pronunciation Committee of the American Chemical Society has been studying these. It has had the help of representatives of the American Physical Society. The committee has reached definite conclusions with reference to most features of the problem, but owing to certain circumstances thinks it best to make only an informal report in the form of this statement by its chairman at the present time. A similar study is being made in England. It is the hope of the committee that by submitting this informal preliminary report it will gain the advantage of suggestions from interested readers, with reference in particular to the more controversial points, as the question of symbols, and that it may be helpful in guiding usage during this early period of activity in which confusion in nomenclature is springing up. A formal report with definite recommendations can better be made a little later and it is promised.

It has been considered important to keep in mind certain general view-points in connection with this work. These take into consideration such matters as (*a*) the existence of many isotopes, (*b*) the fact that the isotopes of hydrogen are still forms of hydrogen and not new elements, (*c*) the effect of names and symbols on ease of thinking, (*d*) the teacher's view-point, (*e*) established nomenclature, (*f*) convenience and (*g*) indexing (this includes the use of indexes). An effort has been made to see the picture as completely as possible and with the broadest view.

Even so it has been considered justifiable to regard hydrogen as presenting a special case. Convenience seems almost to require special names and symbols for the hydrogen isotopes or at least for the isotope of mass 2. Hydrogen is a common element and its compounds are numerous (the whole field of organic chemistry is involved). The differences between isotopes of the other elements will no doubt be slight in comparison. Because of their large mass numbers other isotopes can be referred to by use of the element names followed by the mass numbers more conveniently than can hydrogen.

The committee is of the opinion that under most circumstances, as in compounds as a rule, just the name hydrogen and its symbol H will serve in place of a special name and symbol for the isotope of mass 1. As one committee member put it, "The fact that classical hydrogen has now been shown to have been slightly impure should not lead us to call it anything but hydrogen." It seems likely that there will be circumstances under which it will be helpful and in the interest of scientific exactness to have a special name and symbol for the hydrogen isotope of mass 1, but it is not proposed that the whole of our existing nomenclature for hydrogen and its many compounds shall be revised.

When the committee's work was started the isotope of mass 3 had only been predicted so that the committee did not include it in its program of work. It will no doubt be considered later.

For convenience the isotopes of mass 1 and mass 2 will be referred to as H^1 and H^2, respectively, in the remainder of this article.

Several names have been proposed for the isotopes. None of these has seemed preferable to the names protium and deuterium for H^1 and H^2, respectively, proposed by the discoverers of the isotopes, Harold

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C. Urey, G. M. Murphy and F. G. Brickwedde.[2] Discoverers have a traditional right to suggest names, and the careful consideration which preceded the exercise of this privilege took into account a number of possible names, including diplogen. Protium and deuterium have come into considerable use and it does not seem likely that they can be replaced or that they should be except in so far as protium is discarded in favor of hydrogen. None of the other proposed names seems to have gained any headway in usage, except that diplogen, proposed for H^2 by Lord Rutherford,[3] is being used to a considerable extent in Great Britain. Lord Rutherford's argument is that if deuterium is to be the name for H^2 then G. N. Lewis' suggestion of deuton as the name for the H^2 nucleus follows logically, and deuton "is liable in the spoken word to be confused with neutron." The name deuton has been accepted for use by many. The name hydrogen ("water-forming") is not unique as the name of an element with a -gen ending. The -ium ending as used in deuterium seems appropriate enough in view of the fact that the hydrogen ion is positive, like those of the metals. If diplogen were to be accepted for H^2 in order that diplon might logically be used for the H^2 nucleus then a continuation of this logic would lead to haplogen for H^1 and to haplon for the H^1 nucleus for which the name proton is well established.

The names hydrogen-*p* or hydrogen-*a* and hydrogen-*d* or hydrogen-*b* for H^1 and H^2, respectively, have a certain following. Perhaps, if the names protium and deuterium are adopted officially, hydrogen-*p* and hydrogen-*d*, respectively, might be approved for alternate use, particularly in view of the recommended names for compounds discussed below.

SYMBOLS

There is much difference of opinion both within and without the committee with reference to the most suitable symbols for the hydrogen isotopes. Each of the symbols below has certain advantages and a following:

Protium	Deuterium
H or H^1	H^2
H	D
H or Hp	Hd
H or H*p*	H*d*
H or H*a*	H*b*

Of a considerable number of interested chemists canvassed, including the 20 members of the committee (the ratio is approximately the same within and without the committee), approximately one third like H^2 for deuterium, another third like D, and H*d*, Hd and H*b* share the other third. Those in favor of D are rather emphatic about it. Others consider the use of D "particularly bad." A few object strongly to H^2. The committee finds it difficult to make a definite recommendation in the face of this situation. Perhaps more experience in the use of symbols and a wider canvass of opinion will help in the making of a decision. Time is needed. Opinion outside of the United States is being sought.

The symbols H^1 and H^2 have the advantage of fitting well with the general considerations given in paragraph 2 above labeled (*a*), (*b*), (*c*), (*d*) and (*g*). Perhaps the most striking of these is (*a*), as such a system would be universally applicable to the isotopes of other elements. These symbols picture the meaning well, and the retention of H as the letter of the symbol would help in the listing of hydrogen compounds by empirical formulas, as in indexes, a practise of growing importance with the increasing complexity of chemistry. They are not so convenient as certain other forms. For example, they present a difficulty in the reading aloud of formulas (one might read H^2_2O "H two up two O") and some difficulty in printing, and the fact that the French use superscripts where other chemists use subscripts in formulas might lead to confusion.

The symbol D for deuterium violates general considerations (*a*), (*b*), (*c*), (*d*) and (*g*) above for the sake of (*f*) (convenience). It is desirable for the commoner elements to have a single-letter symbol, and convenience is important. It tends often to be a determining factor. Is it important enough to counteract the other considerations? No doubt the importance of logical considerations can be overemphasized. I have noted that chemists who are talking and writing deuterium chemistry all day long, and perhaps eating and dreaming it, too, tend to use D. It has gotten into the literature perhaps as much as H^2. D must be considered as a strong candidate for official use.

Of the other symbols H*d* seems better than Hd because it helps in identifying deuterium as a form of hydrogen (Hd seems more like the symbol of a separate element, just as Hg is). H*d* fits in with all the general considerations mentioned above except (*a*). It does away with the reading-aloud difficulty, the printing difficulty and the difficulty presented by French practise. It has, however, been found somewhat awkward when used in the writing of formulas and can not be said to have as strong a following as do H^2 and D.

The symbols H*a*, H*b* and H*c* have been suggested as possibilities for protium, deuterium and tritium (H^3), respectively, along with the names hydrogen-*a*, hydrogen-*b* and hydrogen-*c* with the thought that

[2] *Jour. Chem. Physics,* 1: 512–13, 1933.
[3] *Nature,* 132: 955–6, 1933.

possibly such a symbolism and nomenclature could be applied universally to isotopes. The order of discovery, which would likely also be the order of abundance, would probably be the most satisfactory basis for such an allotment of letters for isotopes in general. Order of mass would not work so well because a lower or lighter isotope might unexpectedly be discovered after a higher one had been discovered and lettered with the resulting possibilities for confusion.

The Naming of Compounds

Compounds containing H^2 are being prepared and announced, and the number of these is likely to be large. These should be named systematically and with due attention to the general considerations so often referred to in this article. Some pretty bad names are getting into print. The committee hopes in particular to help in this phase of development by disclosing without delay a line of procedure which it favors in this connection.

In the naming of compounds containing one or more of the isotopes of hydrogen the compounds can either be regarded (*a*) as derivatives of some parent $CH_2H^2_2$ and (*b*) deuterium sulfide for H^2_2S. The latter substance in which hydrogen has been replaced by the isotope or isotopes or (*b*) as compounds of the isotope or isotopes, as (*a*) dideuteriomethane for practise works all right for a few simple compounds, but the former is the main reliance in systematic nomenclature. If applied, however, in the manner usually employed in organic chemistry where the names of radicals entering as substituents replacing hydrogen are introduced as a part of the names of the resulting compounds long and sometimes confusing names result. It would also result in the application to inorganic compounds of a typically organic idea.

With the mental attitude that compounds containing H^2 are after all compounds of a form of hydrogen the committee has sought a system of nomenclature which would result in the least possible change from established nomenclature for hydrogen compounds. Such a system should offer the least obstacle to our mental processes and to effective record-keeping. It is believed that a system has been found which will accomplish this purpose and which stands the test of general application. This system is a modification of one proposed by Willis A. Boughton.[4]

An example of Dr. Boughton's suggestion is the name benzene-p_2d_4 for $C_6H_2H^2_4$. This suggestion has been modified by the omission of "p" for most purposes and by the use of italic "*d*," thus benzene-d_4, and details of application of the system have been worked out (suggestions by Austin M. Patterson, C. D. Hurd and W. R. Stemen have helped greatly). The "*p*" can be used if desired in special cases so that the method is flexible. The following list of names[5] will serve as further examples of the application of the modified Boughton system. For contrast deuterio- names are also given.[6]

With reference back to the lettered general considerations given in the second paragraph it will be noted that the Boughton names conform with (*b*), (*c*), (*d*), (*e*), (*f*) and (*g*). It will also be noted that the other system results in many strange names which, as Dr. Patterson has stated, will have to be

[4] SCIENCE, 79: 159–60, 1934.

[5] It is recognized that the preparation of some of these compounds may not be realizable. The general applicability of the system is our present concern.

[6] If names of this sort are used the committee believes that the prefix should be spelled deuterio- and not deutero- or deuto- because deutero- and deuto- are both in use as prefixes with another meaning (second) in words, both chemical, as deuteroalbumose, and nonchemical. A similar reason makes protio- preferable over proto-.

	Boughton names	Deuterio names
NH^2_3	ammonia-d_3	trideuterioammonia
H^2Cl	hydrochloric acid-d	hydrochloric deuterioacid
$Na_2SO_4 \cdot 5H^2_2O$	sodium sulfate pentahydrate-d_{10} or —penta(hydrate-d_2)	sodium sulfate pentadideuteriohydrate
$NH_2H^2_2OH^2$	ammonium-d_2 hydroxide-d	dideuterioammonium deuterioxide
NHH^2OH^2	hydroxylamine-α,β-d_2	α,β-dideuteriohydroxylamine, or deuterioxyl deuterioamine
CH_3H^2	methane-d	deuteriomethane
$C_6H_5OH^2$	phenol-d	*O*-deuteriophenol or benzenedeuteriol
1, 3- $C_6H_4H^2CH_2H^2$	toluene-α,3-d_2	α,3-dideuteriotoluene
1, 2, 3- $C_6H_3H^2_2Cl$	chlorobenzene-2,3-d_2	1-chloro-2,3-dideuteriobenzene
$H^2HN\overline{C : CH^2 CH : CH \cdot CH : C}H$	aniline-*N*,2-d_2	*N*,2-dideuterioaniline
$CH_2H^2CONHH^2$	acetamide-*N*,α-d_2	*N*,α-dideuterioacetamide
CH_3CH^2O	acetaldehyde-d	acetodeuterialdehyde
$CH_3CH_2OH^2$	ethyl alcohol-d	*O*-deuterioethyl alcohol or ethyl deuterioalcohol
$HOO\overline{CC : C(COOH^2)CH : CH^2CH : C}H$	phthalic-4-d acid-2d	4-deuteriophthalic 2-deuterioacid

deciphered "to find the compounds old friends in disguise." A flood of deuterio- names, some of which would be confusing, would be a real handicap in organic chemistry.

An advantage of the Boughton names is their brevity. Contrast, for example, acetic-d_2 acid-d with dideuterioacetic deuterioacid or possibly protiodideuterioacetic deuterioacid (this last name, if it seemed necessary to designate protium in naming compounds, would by the Boughton system be acetic-pd_2 acid-d).

The objection may be raised to the Boughton system that it mixes names and symbols. There is plenty of precedent for this, however, in the naming of chemical compounds. The method grows in favor as one experiments with it. It apparently leads to the least possible change in established names, which is a consideration of fundamental importance. Another objection is the fact that "p" and "d" are in use in organic chemistry to designate para and dextro, respectively. However, "p" for para can be avoided and it is suggested that in the rare instance in which the dextro difficulty might arise the word "dextro" should be spelled out. The use of the "d" after names instead of before them will also help in keeping this sort of thing clear.

Opinion with reference to such expressions as "heavy water," "heavy ammonia," etc., is that this use of "heavy" is justified no matter what heavy isotope may be represented, whether it be an isotope of hydrogen or another element, and that such expressions, though not scientific, are handy for use in a generic sense.

The committee is willing to try to help individuals working in this field who may be confronted with nomenclature problems during this period when there is little or no precedent and it is so desirable for a consistent and effective nomenclature tool to be forged.

SCIENTIFIC EVENTS

THE CENTENARY OF PHOTOGRAPHY

ACCORDING to the London *Times,* a gathering took place at Lacock Abbey, Wiltshire, on June 16, to celebrate the centenary of the invention of photography and to do honor to Henry Fox Talbot, who, in 1834, working in that house, first succeeded in producing photographic impressions on paper. The Royal Photographic Society and other photographic bodies, especially in the west of England, were represented by their presidents and many members.

A large exhibition of Fox Talbot's early apparatus and of his negatives and prints was arranged in the gallery. The pictures included many of his "photogenic drawings," dated 1835 to 1840, before the introduction of a permanent fixing process, and among these was probably the earliest existing photograph—a window in Lacock Abbey, showing the tracery and the diamond leaded lights against the sky. There were a large number of examples of the calotype process, following the discovery of the latent image, and also an exhibition of Fox Talbot's later work in the direction of photo-engraving. Among other relics was a letter from Sir J. F. W. Herschel, in 1839, suggesting the term "photographic" in place of Fox Talbot's word "photogenic."

The *Times* states that the guests were received by Miss M. T. Talbot, granddaughter of the inventor, and the present lady of the manor, and an address on the personality of Fox Talbot was given by a grandson, Prebendary W. G. Clark-Maxwell, who said that it was while on his honeymoon in 1832 that Fox Talbot, having failed to sketch the scenery of Lake Como by means of the *camera obscura,* set himself definitely on the path which led to photographic discovery. The most puzzling feature of his career was his strong insistence on a series of patents, but it was not the need of money which impelled him, for he had no necessity on that score, nor was it greed, for that was not his nature, but it was in order to vindicate by a legal declaration the priority of his discovery.

Herbert Lambert, of Bath, said that, although Fox Talbot's first experiments were carried out in 1834, it was not until 1839 that, stimulated by the work of Daguerre, he announced his invention to the Royal Institution, a few days before Daguerre made his communication to the French Academy. It was a remarkable instance of two men working along independent lines and making what were really two different inventions with the same end in view, for, although Fox Talbot's calotype and the Daguerre process both used as their basis the sensitiveness of silver salts to light, the methods and chemical reactions were quite different. Daguerre used silvered plates which he sensitized with iodine and subsequently developed by mercury vapor, while Fox Talbot produced a sensitive paper which he developed with gallic acid and fixed with hyposulphite of soda. The really important invention by Fox Talbot was made in September, 1840, showing the way in which the latent image could be developed. It was this which distinguished his early photogenic drawings from the calotype or talbotype process which he patented in 1841.

A. J. Bull, president of the Royal Photographic Society, reviewed Fox Talbot's later work, culmina-