idea as to the quality of the sample may be obtained, and it may be ascertained beyond a doubt whether it is fit for the manufacture of nitro-glycerine for which so much of the refined glycerine of commerce is used.

UNITED STATES LABORATORY,

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THE NOMENCLATURE AND NOTATION OF ALKALOIDAL SALTS.

BY S. W. WILLIAMS.

Now that the U. S. Pharmacopœia is about to be revised, it seems eminently proper that the American Chemical Society should recommend a system of nomenclature and notation for alkaloidal salts more consistent than that adopted by the last Committee of Revision.

Four names and four formulas fairly representative of the terminology and symbolic representation of salts formed by acids, with alkalies and alkaloids, should be sufficient to demonstrate that a wider divergence from consistency could hardly have been attained :

Pharmacopœial Name.	*Pharmacopœial* Formula.
Ammonium bromide.	NH_4 Br.
Quinine hydrobromate.	C_{20} H_{24} N_2 O_2 H Br.
Potassium sulphate.	K_2 S O_4
Quinine sulphate.	$(C_{20}$ H_{24} N_2 $O_2)_2$ H_2 SO_4.

Note as inconsistencies :

1. Writing a salt as a hydrobromide and naming it a hydrobromate.

2. Calling one salt of hydrobromic acid a hydrobromate and another salt of the same acid a bromide.

3. Recognizing in the name of one salt the unreplaced hydrogen of the combining acid and ignoring the same unreplaced hydrogen in another.

4. Making the name sulphate applicable to both metallic and alkaloidal salts of sulphuric acid, while the term bromide is made inapplicable to both metallic and alkaloidal salts of hydrobromic acid, practically the same difference existing between metallic and alkaloidal salts in one case as in the other.

5. (Should the ammonium theory be offered in partial explanation): Incorporating the hydrogen of the combining acid with the base in the case of $N H_4 Br$ and not doing so in the case of

$$C_{20} H_{24} N_2 O_2 H Br.$$

In my opinion to prove quinine hydrobromate a correct term requires evidence that a "bromide" is a "bromate." To make quinine sulphate anything more than a defective name (correct, however, as far as it goes). requires for consistency that the notation be changed from

$$(C_{20} H_{24} N_2 O_2)_2 H_2 SO_4 \text{ to } (C_{20} H_{25} N_2 O_2)_2 SO_4,$$

this change resulting in the second inconsistency of calling $C_{20} H_{24} N_2 O_2$ (the free alkaloid capable of individual existence) by the same name as that given to $C_{20} H_{25} N_2 O_2$, a hypothetical base as yet, so far as the writer knows, not proved to be capable of standing alone.

If accepted notation is to stand as it is, the writer would argue for such terms as hydrobromide and hydrosulphate (obsolete for sulphide) as accurately descriptive of the formulas given by the Pharmacopœia and authorities generally, these terms to be abbreviated for convenience, and perhaps reasonable conservatism in the case of oxyacid salts, to "bromide" and "sulphate."

The only change in notation which seems to commend itself at all is the incorporation of the unreplaced hydrogen of the combining acid with the hydrogen of the base—a change based upon the ammonium theory. The question here presents itself: Is the theory sufficiently well established to warrant such alteration? Do we *know* even that "$N H_4 O H$" is more than a mere solution of $N H_3$ in $H_2 O$?

Several years ago the writer, then engaged editorially on a weekly pharmaceutical journal, endeavored to bring the subject of

correct names for alkaloidal salts prominently before pharmacists, and many members of this society then joined in the resulting discussion with considerable interest. Of twenty-seven chemists who gave their opinions but four favored at all the terminology adopted by the Pharmacopœia for the alkaloidal salts of alkaloids containing hydracids. The principal "argument" advanced by the small minority was practically: "It is correct because long ago adopted and now employed," substantially the same thing as saying that chemical terms are mere conventionalities.

Our objections at the time were made principally against such terms as hydrochlorate, hydrobromate and hydriodate, claiming the greater accuracy of the names hydrochloride, hydrobromide, hydriodide, etc. The latter terminology, though practically unrecognized in the trade, and in pharmaceutical and even most chemical literature, had nevertheless been adopted by the English Chemical Society and has now the support of our own organization. It is needless to argue here the desirability of making pharmacopœial terminology not only consistent with itself but so far as practicable with the language of chemistry. It would certainly have been no greater change to substitute the term hydrochloride (signifying an "addition product" with H Cl) for "muriate" (U. S. P., 1870), than to impose a name of exactly the same length which indicates an "addition product" with chloric acid, the prefix "hydro" suggesting unreplaced hydrogen in both cases.

Claiming no consideration for his personal views, the writer would however ask a careful perusal of the following brief extracts from letters * written by chemists who may be taken as fairly representative authorities:

[The example taken for discussion is the salt formed by cocaine with hydrochloric acid.]

Professor Wolcott Gibbs (Harvard):

* * "I should myself prefer to call it the *hydrochloride* of co-

* The letters will be found in full in reprints from the "Weekly Drug News," '84-'85, published in pamphlet form by the "Druggists' Circular," 72 William St., New York. The book, entitled, "Cocaine Hydrochloride as the Name of the Salt formed by Cocaine with Hydrochloric Acid and a Discussion of the Nomenclature of Alkaloidal Salts in General," may be obtained from the publishers.

caine, adopting the nomenclature proposed some years ago in England, I believe by Prof. Foster."

Professor John Howard Appleton (Brown):

"My personal feeling is that the new local anæsthetic had better have the word *hydrochloride* than hydrochlorate as a part of its name. * *

Professor A. A. Breneman (late of Cornell University), [after remarking upon the propriety of applying the ammonium theory to alkaloidal salts, and calling the salt coconium chloride]:

"My own preference, therefore, would be for the term 'hydrochloride of cocaine,' or rather, in accordance with present usage, *cocaine hydrochloride*, to designate the new remedy and as a typical name for compounds of this class. I cannot think that usage in favor of the term 'hydrochlorate' is yet so firmly established as to forbid a change so desirable."

Prof. F. W. Clarke (Smithsonian Institution):

"I prefer to use either 'hydrochlorate' or 'hydrochloride.' 'Chloride' is bad, because it ignores the hydrogen, which is essential to the compounds. * * * * Probably the terms sulphate, hydrochlorate, etc., are, all things considered, best; for, after all, these names are mere conventionalities." * *

Prof. John M. Maisch (Philadelphia College of Pharmacy):

* * "As far as my personal preference is concerned, I am rather in favor of hydrochlor*ide*, etc., as a good descriptive term for salts containing the hydrogen compounds of halogens; therefore: hydrobromide, hydrocyanide, etc., is analogous to chloride for compounds containing Cl."

Prof. P. T. Austen (Rutgers College):

"I am glad to see that you are endeavoring to correct the popular error into which some writers have fallen in using the term cocaine hydrochlorate. The addition compound of cocaine with hydrochloric acid is properly called cocaine hydrochloride. You will find this matter of nomenclature very exactly stated in the Nineteenth Instruction to Abstractors published by the late Henry Watts, F. R. S., F. C. S., in the Journal of the English Chemical Society (1879, vol. 35, p. 281). * * The use of the name cocaine chloride is also wrong, since this would signify that

the salt was formed by the replacement of the atom of hydrogen in hydrochloric acid by cocaine, which is not the case."

Prof. Ira Remsen (Johns Hopkins' University), [after commenting upon the analogy between ammonium and alkaloidal salts]:

"The salt is therefore the chloride of this hypothetical substance, and, to give it a systematic name analogous to that of ammonium chloride, we should be obliged first to find a name for this hypothetical substance. We might, for example, call the latter *cocainium*. Then the salt would be namely *cocainium chloride*. In short the salt *is* a chloride; but, to avoid the necessity of giving a special name to the substance with which the chlorine is combined, it appears better to adopt a generic name for all similar salts, and, as they all contain this extra hydrogen, which is the cause of the trouble, the name best suited to call attention to the fact is, perhaps, *hydrochloride*. * * * Such names as *hydrococaine chloride, hydroquinine nitrate*, etc., would be the best, and, save that they are new, they are entirely unobjectionable."

The late Prof. Henry B. Parsons (then editor Druggists' Circular):

"* * As to the respective merits of the terms *hydrochlorate* and *hydrochloride*, as applied to salts of alkaloids, it may be stated—

1st. The usage of the English and U. S. Pharmacopœias is on the side of the termination *ate*.

2d. Some of the best chemical writers, however, use the more correct termination *ide*. * * * As the termination *ide* is proper in connection with mineral salts, and as no confusion can result from its adoption in naming salts of alkaloids, while uniformity will be promoted thereby, it seems to me preferable to write *cocaine hydrochoride* in place of cocaine hydrochlorate."

Prof. W. H. Greene (Central High School, Philadelphia):

"* * The word hydrochlorate—a direct translation of the French *chlorhydrate*—is, without doubt, objectionable for a compound which is not in any manner a hydrate or a chlorate. * * In conclusion, nomenclature should be as concise and simple as is consistent with precision. If, then, *cocaine chloride* is not

sufficiently definite, let it be *cocaine hydrochloride,* but not hydrochlorate."

Dr. D. K. Shute (Washington, D. C.):

"* * Your argument against the term 'hydroclorate' is very conclusive, at least as far as modern scientific chemistry is concerned. I cannot agree with you, however, that 'hydrochloride' is more correct than *chloride* and, therefore, preferable to it." [This writer goes into an argument for the term "chloride" based upon the ammonium theory.]

Professor A. B. Prescott (Michigan University):

"* * You recommend that the change in the word-ending for these salts, from -ate to -ide, a change already made and being made in the language of chemists be adopted in the language of pharmacists. It is well that the use of terms in pharmaceutical commerce shall not fall far behind the use of terms in chemical science. In fact, the closer are all the relations between applied science and pure science, the better it is for the progress of each. The world of manufacture and of use stimulates and is strengthened by the world of investigation and discovery." * * *

Prof. S. W. Johnson (Yale University):

"* * The name hydrochlorate of cocaine is correct as is also the term hydrochlorate of ammonia. These are both correct because chemists long ago adopted and now employ them." * *

Prof. Sidney A. Norton (Ohio State University):

"Your editorial seems to fill the bill, and to show that cocaine hydrochloride is the best name." * * *

Prof. H. A. Mott (New York):

"Keep on agitating the question of scientific nomenclature. * * The compound $C_{17}H_{21}NO_4HCl$ can only be correctly represented by the name *Cocaine Hydrochoride;* the ending 'chlorate' is very misleading and should not be employed."

Wm. Rupp F. C. S., (New York), [explaining the combination of an acid as a whole with an alkaloid in virtue of a gain in quantivilence of two bonds by the nitrogen, and commenting on the application of the ammonium theory to salts of the alkaloid, morphine for example]:

"* * If this were done the analogy with the ammonium

compounds would be complete, and the term *morphonium chloride* would be correct ; whereas nothing will justify the term *morphine chloride.*" * *

Prof. Maurice Perkins (Union College):

"* * I think the termination 'ide' much better than 'ate,' for this latter would seem to indicate that the acid radical contained oxygen, which it does not."

Prof. J. P. Remington (Philadelphia College of Pharmacy):

"* * My own view is, that the combinations of the hydracids with alkaloids are properly termed *hydrochlorides*, etc.; that chloride bromide, iodide, etc., are proper terms to use, when halogen acids combine with metals, and the hydrogen *is* replaced, is now generally accepted ; what more rational view can be taken than to indicate the *presence* of hydrogen, in the compounds wherein the hydrogen has *not* been replaced, by the addition of the *descriptive prefix hydro.*" * *

Prof. N. T. Lupton (Vanderbilt University):

"* * My personal preference is to call such compounds chlorides and not hydroclorides, but as stated above, I follow the usage of the journal of the Chemical Society of England and call the compound formed by the action of hydrochloric acid on cocaine, cocaine hydrochloride."

Prof. George T. Barker (University of Pennsylvania), [after reviewing the history of the terms in question and commenting on the ammonium theory]:

"* * My judgment, therefore, is : 1st, that the term 'hydrochlorate' is entirely inadmissable having neither precedent, analogy or sound reason in its favor; 2d, that the term 'hydrochloride' is anomalous and unscientific, though preferable to 'hydrochlorate;' and 3d, that, in accordance with the spirit of the Lavoisierian nomenclature, the term 'cocainum cloride' is to be recommended as having the most points in its favor."

Prof. W. G. Levison (Cooper Union) :

"* * It might be interesting to subject the cocanium compound to electrolytic examination, though negative results would probably be obtained as in the case, so far as I know, of the other alkaloidal hydrochlorides. Until, however, a radical ($C_{17}H_{22}NO_4$)

is in some way demonstrated to form, the noncommittal name of cocaine hydrochloride seems least objectionable."

Dr. A. B. Lyons (Detroit):

"* * Now, the question has narrowed itself to this; is it best, all things considered, to distinguish the ammonia cocaine ($C_{17}H_{21}NO_4$) from the base radical, $C_{17}H_{22}NO_4$? If so, the distinction can best be made as in the case of ammonia itself, by simply changing the *a* of the (Latin) name into *um*. Our compound will therefore be called, for precision, cocainum chloride. * * * I would give the name cocaine to the radical which, by its direct union with chlorine forms the chloride—for I believe that Cl is monad in this compound as in other chlorides—and, if necessary, would distinguish as cocaine alkaloid the compound ammonia commonly designated simply as cocaine."

Prof. F. B. Power (University of Wisconsin):

"* * We know that many alkaloids are capable of absorbing hydrogen and forming 'hydro' compounds, and to such addition products this expression should be reserved. Should cocaine be found to possess this property its salt with HCl would then be a *hydro*-cocaine, hydrochloride, or hydrochlorate. There seems to me but little double regarding the propriety of the term hydrochloride as opposed to hydrochlorate." * * *

Prof. Charles A. Doremus (Bellevue Medical College):

"* * I prefer the term cocaine hydrochloride, though the salts of the alkaloids with hydrochloric acid are termed hydrochlorates by many eminent chemists, and have therefore the sanction of authority. There would be no objection to either the term 'cocanium chloride' or 'hydrococaine chloride.'" * *

Prof. Oscar Oldberg (Chicago College of Pharmacy):

"* * It seems to me important not to overlook the fact that the nomenclature of the compounds formed by alkaloids with hydr-acids must be in perfect harmony with the names of alkaloidal salts of the oxy-acids. It is at least consistent to say cocaine chloride when we say morphine sulphate. * * * Professor Remsen's suggestion is, to my mind, the only proper one to acrept."

Dr. Lawrence Wolff (Philadelphia):

"* * I am in favor of the term 'cocaine chloride' modified from the term 'hydrococaine chloride,' as proposed by Prof. Ira Remsen." * * *

Prof. John Attfield (London, Eng.):

"* * Expediency may, and I think does, suggest the name 'hydrochlorate of cocaine,' and consistency, as far as it goes, supports expediency; but what philological correctness points to I cannot say. * * Remember that in our choice of such terms we are not guided by the laws of nature, but by a jumble of conventions. There is much to be said for the words of which 'hydrochloride' is an example, and nothing but good to all interests concerned is likely to come out of a discussion on chemical nomenclature in your columns."

Prof. J. U. Lloyd (Cincinnati, O.):

"* * 1st. If an alkaloid unites with HCl so that the hydrogen is separated from the chlorine, which then acts as a radical, according to present usage the compound should properly be called a *chloride*.

2d. If the combination HCl is known under the name of hydrochlor*ic* acid, and, if it is the custom to call compounds of this acid in which the entire undecomposed acid is involved by the name hydrochlor*ate* (as I think most writers now use it), then the union of cocaine and HCl could be called hydrochlor*ate* of cocaine.

3d. If the combination HCl is regarded as hydric chloride, or chloride of hydrogen, and the undecomposed compound HCl is supposed to unite with the alkaloid, I do not see why the term cocaine hydrochloride is not in conformity with our ordinary nomenclature." * *

Space will not admit of doing anything like justice to the writers of the letters quoted from. It will be observed from the foregoing opinions that there are *many* arguments against the pharmacopœial terminology and practically *none* for it. A change is therefore clearly indicated. What shall the change be?

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