THE DEPARTMENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

The teaching of incompatibilities in prescription compounding is of less importance to-day than it was fifty years ago, due to the fact that specifics and active constituents are used more to-day than they were in the past. However, incompatibilities are still prescribed and only recently my attention was called to one of the most incompatible prescriptions I have ever seen. The physician who wrote this prescription had forgotten most, if not all, of his chemistry and the mixture was almost an impossible one. The pharmacist recognizes that it is his duty to overcome these incompatibilities when they occur; therefore the following paper by Dr. Husa will be of interest to all teachers of pharmacy and I believe the average retail druggist will find much of interest in it.—C. B. JORDAN, *Editor*.

THE TEACHING OF INCOMPATIBILITIES IN PRESCRIPTIONS.*

BY WILLIAM J. HUSA.**

In opening a discussion on the teaching of incompatibilities in prescriptions, it will be well to enumerate some of the principal difficulties which are to be surmounted, and to take stock of the advantages we have that will assist us in the task.

One of the difficulties which immediately suggests itself is the large number of incompatibilities which, conceivably, may occur. Given hundreds of drugs and preparations, an almost inconceivable number of combinations may be made. For example, 500 drugs or preparations will make 257,838,552,475 different combinations, using from one to five items in each combination. It is evident at once that the subject cannot be presented by discussing any appreciable percentage of the incompatibilities that may occur, but that general principles must be enunciated, and practice given in the application of these principles to actual prescriptions.

Another difficulty is that individual opinions differ so widely on how even relatively common incompatibilities should be handled. Whenever incompatibilities are brought up for discussion at pharmaceutical gatherings, and reports made on how certain incompatibilities were overcome, there rarely ever is even the semblance of an agreement among those present as to what should be done. Some say they would do one thing and others say they would do another. Some will recommend certain changes, either with or without the consent of the physician; inevitably, someone will rise to remark that the pharmacist should not make the slightest change without the consent of the physician.

Along with the usual difficulties encountered in attempting to teach anyone to think, reason and develop judgment, rather than to merely memorize and be able to repeat a number of facts, the obstacles mentioned represent the high points in our problem.

An advantage that we have is that, presumably, the students have been well prepared in earlier work. The courses in general chemistry, qualitative and

* Presented before the Pharmacy Laboratory Teachers' Conference, American Association of Colleges of Pharmacy, Baltimore meeting, 1930.

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quantitative analysis, and organic chemistry should prepare the student for the chemical problems that will arise. The courses in botany and pharmacognosy, along with the courses in pharmacy, should give the student an understanding and knowledge of the constituents of crude drugs and preparations thereof. In connection with the courses in theoretical pharmacy, and the manufacture in the laboratory of various preparations, the statement is sometimes made that these courses are not of much value in these days when many pharmacists buy practically all preparations ready made. People who make such statements overlook the fact that it is in these courses that the student becomes familiar with the exact nature and composition of pharmaceuticals, and learns to recognize them by sight and smell, and that the knowledge here obtained as to methods of combining various types of drugs gives the foundation for successful prescription work. The courses in pharmacology lay the foundation for consideration of therapeutic incompatibilities.

The course in prescriptions should therefore be correlated with the previous studies which the student has had. By leading the student to apply the knowledge he already has, the course in prescriptions will be a keystone in the arch of pharmaceutical knowledge. One difficulty here is that our students fail to review sufficiently; their tendency is to promptly forget a course as soon as they have obtained a passing final grade. To minimize this difficulty I encourage the students to review those portions of their previous work which are particularly needed at any given time.

A systematic arrangement of the work on incompatibilities will facilitate the review work and correlation. I have found it best to take up first the incompatibilities of the inorganic compounds and to take these up in the order of the groups which the student learned in qualitative analysis. Thus in beginning the study with silver, lead and mercurous compounds, the student is advised to review the chemistry of these metals and the methods of separation used in qualitative analysis. Later a recitation is held in which applications and correlations are brought out. For example, a question regarding the solubility of chlorides shows how the group separation indicates that the chlorides of these metals are insoluble, while the chlorides of other common metals are soluble. The question may be asked as to which metal appears in both the first and second groups and what the significance of this is, thus bringing out the fact that lead chloride is appreciably soluble. Such points help develop a general knowledge of solubility relations which will be of value in cases of incompatibility due to insolubility, *i. e.*, the so-called pharmaceutical incompatibilities.

Since the cations in each group have certain chemical properties in common, which caused them to fall together in the group separation, they will also be found to have some similar incompatibilities, and this classification is thus a logical one from the standpoint of classifying the study of incompatibilities. Organic compounds may similarly be classified in groups according to the classification the student has had in previous courses.

It is important to have the student carry out a great many laboratory experiments in which he will see for himself the various incompatibilities, and secure practice in methods of overcoming them. In order to avoid confusion in the student's mind, I have classified the work into two parts, *i. e.*, (1) test-tube experi-

ments, and (2) compounding of prescriptions in finished form. Thus test-tube experiments are assigned to show the various incompatibilities, regardless of whether or not they would be dangerous to dispense, while the prescriptions which are compounded, labeled and filed in the student's prescription file cover the cases in which the incompatibility has been modified or overcome so as to be safe to dispense.

The textbooks used in my classes are Scoville's "Art of Compounding" and Ruddiman's "Incompatibilities in Prescriptions." In taking up the incompatibilities of the salts of a certain metal, there is first a review of the chemistry of the metal, followed by test-tube experiments. Since the incompatibilities under each heading in Ruddiman's book are numbered, the assignment for the test-tube experiments may be conveniently given by posting a sheet on which the numbers are listed. The student is required to make a condensed entry in his note book covering each test-tube experiment, which may be in the form of the chemical equation for the change which has taken place, precipitates, color changes, etc., being appropriately indicated. At convenient intervals during each laboratory period each student receives individual attention, his note book and test-tubes being examined and compared. If everything is satisfactory, the test-tubes are then emptied into the sink and the note book is marked as approved.

The emptying of the test-tubes into the sink in the presence of the instructor is an important practical teaching point—there is thus less likelihood of the same tests being submitted for credit by a number of different students. The careful checking of each test-tube by the instructor gives the best check on the quality of the work and the correctness of the results.

The prescriptions which are compounded are taken from such books as the two textbooks already mentioned, "Merck's Manual," etc., and from original sources. After the test-tube experiments of the compounds of a certain element are completed, a number of prescriptions are filled involving the points illustrated. In each case, also, a number of prescriptions are assigned which represent typical prescriptions, such as are compounded every day in the drug store; these usually do not show any incompatibilities. Other prescriptions are assigned which are incompatible as written, but which may be safely dispensed if compounded in a certain way or with some modification. Usually a reference or suggestion is given to aid the student in overcoming or avoiding the incompatibility. In some instances I like to have the student fill such a prescription in two or three ways, in order that he may have definite proof of the alleged improvement, and in order to give him a little of the research spirit.

Following the laboratory work, the ability of the student to apply his knowledge to new prescriptions may be tested and developed by presenting other prescriptions for purposes of recitation and discussion in the class room work.

In regard to the question of what to teach regarding the right of the pharmacist to make changes in prescriptions, there is perhaps some room for application of the well worn phrase that the function of education is to teach the students "how to think, rather than what to think." There should be a discussion of the principles involved, bringing out such points as respect for the intent of the prescriber and consideration of the welfare of the patient, as well as the fact that the well-trained pharmacist is, in general, much better informed than the physician

on methods of combining drugs. Emphasis may be given to the theory that the choice of pharmaceutical details which do not conflict with the intent of the physician should be left to the pharmacist. The student should be encouraged to establish cordial professional relations with physicians and to respect their wishes in regard to whether or not they wish to be consulted about minor improvements in prescriptions.

To summarize, the main points in my system of teaching incompatibilities in prescriptions are as follows: (1) a review of the essential facts and principles learned in previous courses in order to secure maximum benefit from previous work, (2) direct observation of numerous incompatibilities by test-tube experiments, (3) adequate practice in compounding prescriptions so as to overcome or avoid apparent incompatibilities, (4) recitation and discussion emphasizing the principles involved, with mental practice in the application of the principles to other prescriptions.

THE CINCHONA TERCENTENARY IN ENGLAND.

The late Dr. E. M. Holmes wrote an article on "Three Hundred Years of Cinchona" for the *Chemist and Druggist* of June 28, 1930. This contribution gave a short account of the discovery and the application of Peruvian bark since its first European use in 1630. In the introductory paragraph he said "a history of the introduction of Peruvian bark into Europe as a febrifuge three hundred years ago is one of the most interesting in the domain of medicine and 1930 forms the appropriate anniversary for recalling the curious facts of the discovery of its properties," etc.

Reference has been made in the JOURNAL to the tercentenary celebration at the Missouri Botanical Gardens, October 31st and November 1st.

The Wellcome Historical Medical Museum in London has a large and interesting collection of material that concerns the history of cinchona. A celebration was held at this museum on December 8th; among the speakers on that occasion were Cardinal Bourne, the Spanish and French ambassadors and the Peruvian Minister. A statement was made by the latter which does not agree with other accounts of the early use of cinchona. He stated that "the second wife of the fourth Count Chinchon, never returned to Spain and that therefore neither she nor the Count's first wife could have been instrumental in the distribution of cinchona in Europe."

Professor Van der Wielen gave an interesting résumé of the early cultivation of cinchona in various parts of the world. Among the exhibits at the Wellcome Museum there are specimens of cinchona bark brought from Peru to Spain in 1777 by Ruiz and Pavon; also, original specimens of quinine and cinchonine prepared by the French pharmacists, Pelletier and Caventou, in 1827. In the exhibit there are also several small gilt-labeled containers from an old Jesuit pharmacy in Granada dating back to the 17th century. Prof. A. Tschirch has contributed a number of interesting specimens, including a lump of cinchona extract in a calabash.

The records contain books and manuscripts of the early history of cinchona. In the list of explorers the name of Dr. Wellcome is given, whose visits to various parts of the world, investigating the sources and possibilities of cinchona, date back to the year 1879. A ledger from Peretti's pharmacy in Rome and old laboratory manuscripts of the Howard's are also included in the collection.

Merck & Co. have issued many interesting pamphlets, recent ones relate to early traditions concerning cinchona bark and its use in malaria and the story of quinine. An interesting display of cinchona products was made at the 300th anniversary celebration of the use of cinchona. A pleasing feature of these notes is that due credit is given to Pelletier and Caventou as *pharmacists*—a comment follows: "Pharmacists have made many such valuable contributions to medical science, while giving time, skill and sympathetic coöperation to the communities they serve."