THE DEPARTMENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

C. B. JORDAN—CHAIRMAN OF EXECUTIVE COMMITTEE, A. A. C. P., EDITOR OF THIS DEPARTMENT.

"The teaching of pharmaceutical arithmetic received considerable attention at the last meeting of the Teachers' Conference at Miami and the following papers were presented. It is my understanding that more students fail the State Board Examinations in pharmaceutical arithmetic than in any other subject. Therefore, the teaching of this subject should receive careful consideration. It is hoped that these two papers will arouse discussion. Comments or papers on the subject will be gratefully received by the Editor of this Department.—C. B. JORDAN, *Editor.*"

PHARMACEUTICAL ARITHMETIC METHODS USED IN LABORATORY TEACHING.

BY A. O. MICKELSEN.*

The application of theory is the utilization of knowledge derived from a theoretical training. A theoretical training in mathematics is not sufficient to qualify a pharmacy student for practical work behind a prescription counter; the better plan is to couple the theory with laboratory work in pharmacy. It is rare to receive a prescription not requiring the application of mathematics in its compounding. If the compounder has had laboratory mathematics, he does his work at the prescription desk, unconscious of the mathematics involved. There are numerous practical men who are failures so far as theoretical mathematics is concerned, but are safe and practical pharmacists due to their laboratory experience in handling weights and measures.

The importance of the laboratory mathematics cannot be overstressed. The writer need only name one incident to illustrate the value of laboratory mathematics; the case of a corporal at Leavenworth, Kansas, who attempted to weigh $^1/_{200}$th grain of atropine sulphate, resulting in the death of two children. This undoubtedly was not through lack of theoretical mathematics, but through lack of experience in attempting to weigh such a small quantity of a potent drug. The student should be taught to use tablets rather than attempting to weigh such small quantities of potent drugs. The laboratory experiment should be continued, however, by giving the freshman student some potent drug, as strychnine sulphate, requiring him to weigh $^1/_{40}$th grain, using a quantity of strychnine sulphate large enough to be weighed, one or two grains, and incorporating with some inert powder and coloring matter; mixing the powders until an even color results and reweighing a calculated portion of the powder containing $^1/_{40}$th grain of strychnine. Such experiments avoid accidents similar to that referred to.

A few examples for discussion should suffice as a general idea of this subject since time will not permit a detailed paper. Alligation is an important phase of mathematics and will serve as an example. Alligation can be effectively demonstrated in the freshman pharmacy laboratory work by the use of standard chemical solutions. To illustrate, the following problem is given:

In what proportion should three solutions containing 7%, 16% and 18% be

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mixed to obtain a resulting solution containing 11%. The answer: 12 parts of the 7% solution and 4 parts each of the 16% and 18%. Procedure: Label three bottles 7%, 16% and 18%, respectively. The 7% solution is a known hydrochloric acid solution containing a few drops of phenolphthalein indicator, leaving it a clear solution, titrated so that one and one-half cubic milliliters neutralizes one cubic milliliter of a known solution of sodium hydroxide. The solution of sodium hydroxide is placed in the bottles representing the 16% and 18% solutions. If the student's calculations are correct, and the solutions carefully measured, 12 parts of the hydrochloric acid will exactly neutralize 4 parts each of the sodium hydroxide and a pink solution results.

The freshman student is not familiar with volumetric chemistry and no explanation is necessary. The fact that if his work is accurate the solution turns pink, impresses the student with the principles of alligation, checks the accuracy of calculations and measuring solutions. The writer is aware of the fact that if a greater quantity of sodium hydroxide solution is used than is required, a pink solution will also result, but this can be detected by a greater intensity of color due to the hydroxyl-ion concentration. In spite of this defect this method of demonstrating alligation has proven very effective. Numerous problems can be demonstrated by the use of volumetric solutions and indicators prepared by upper classmen in the chemistry department. Various other experiments illustrating mathematics should be given in the freshman year, using Metric, Avoirdupois and Apothecaries' weights and measures.

For more advanced work, such as prescriptions, every prescription should involve a mathematical problem for the student. Illustrating, the following prescription is used:

Ammonium Chloride	℥ ii
Diluted Hydrocyanic Acid	♏ xxiv
Codeine Sulphate	gr. iii
Syrup of Wild Cherry	f℥ iii

The student should fill this prescription using the Metric weights; calculate the number of U. S. P. doses of the codeine sulphate; determine whether or not this prescription is within the exempt narcotic class, or if the container should bear a narcotic label. The student may also be asked to change the prescription to a greater or lesser quantity than the prescription calls for. The idea is to couple the prescription with mathematical problems and require the student to hand in his work in detail.

Mental calculation should be taught. The accomplishment of being able to calculate with the aid of pencil and paper is not sufficient for the busy practical pharmacist; the student should be taught mental calculation as well. For this work the writer projects numerous original prescriptions on a screen, calling on students for rapid oral calculations and reading, thus training in reading and rapid calculation.

In conclusion, the writer is not attempting to outline a complete course in laboratory mathematics, but is desirous of exchanging ideas in this important phase of pharmaceutical training and recommends that mathematics be stressed in the pharmacy laboratory work throughout the entire four years of training.

Our pharmacy textbooks offer a number of experiments that should not be overlooked and when the U. S. P. and N. F. are used, there are numerous ways of incorporating mathematics with the laboratory work without detracting from the phase of dispensing or compounding, yet making the experiment more practical.

PHARMACEUTICAL ARITHMETIC AS A SEPARATE COURSE.

BY RALPH L. CALVERT.*

A course in pharmacy includes many subjects which are more or less closely related to each other, and in most of these subjects a fundamental knowledge of ordinary arithmetical calculation is essential. Therefore, it would seem necessary for the pharmacy student to have had a thorough understanding of simple arithmetical processes in grammar and high school prior to his entrance in the pharmacy school.

The difficulty, which we as teachers find in the failure of some students—a group representing probably one-fourth of the class—to grasp the principles of pharmaceutical arithmetic, lies in the fact that they have not been properly trained in the grammar and high schools. The only way we can expect to make them understand their work in this subject is to place them in a separate class and present the material in a different way. Otherwise, the better students in the class become uneasy, bored, and their interest and enthusiasm soon begin to fade.

The writer has noticed over a period of ten years that those students who make poor grades in chemistry or physics also make poor grades in pharmaceutical arithmetic.[1] As a matter of fact all those subjects which require arithmetical procedure in one way or another invariably tabulate the same when comparisons are made.

We must realize that many of our students matriculate without any previous practical experience and that many of those who have had some experience in a drug store lack the kind of experience which was once received before the advent of the soda fountain, the jewelry, sporting goods or sundry departments.

We must also realize that the pharmacy student has more subjects to study in our colleges to-day than he had a few years ago and while the school hours are longer yet the relationship of the college to the drug store is not proportionately the same to-day as it was some years ago. Therefore, different teaching methods of approach and attack must be used if we expect the student to benefit by our enlarged and better course.

It would seem quite necessary that the pharmacy student should have at least one hour of instruction in pharmaceutical arithmetic each week during his entire freshman year, and at least one hour a week for one semester during his senior year. With the inauguration of the four-year course it seems the proper procedure would be to have one hour a week for the entire freshman year and the same for the senior year. Surely, if we expect our pharmacy graduates to be good pharmacists, the one thing in which they should be well grounded should be that of being able to make necessary calculations correctly and with dispatch.

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[1] See reports of Fairchild Scholarship Committee.—E. G. E.