Antiseptics
  Phenol co-efficient, etc.
  Common uses
Astringents
  Effects on tissues
Effects of acids and alkalies
  On protein
  On mucous membrane
Preparation of colloidal solution gels
  Importance in drug action

Physiological Experiments.

Irritants and demulcents
  On skin and mucous membrane
  Local anesthesia on a frog
  Local anesthesia on a man
Administration of anesthetics (rabbit)
  Ether
  Chloroform
  Chloral hydrate
Magnesium sulphate
Effects of (rabbit)
  Morphine
  Chloroform
  Chloral hydrate
  Magnesium sulphate
Action of: (frog, guinea pig and cat)
  Digitalis
  Atropine
  Pilocarpine
Effect of drugs on circulation (dog or rabbit)
  Demonstration
Effects of drugs on G. I. tract (rabbit)
  Demonstration

This course will be given throughout the senior year and will be supported by the courses in Dispensing. The course as originally given will be continued for graduate study.

I am certain that the work which we have been giving during the past four years has enabled our students to have a better understanding of the whole field of therapeutics. It has impressed upon them the need for care in preparing sterile solutions for hypodermic injections, intravenous use of glucose, and an accurate physiological salt solution.

They know why a doctor prescribes an Eggleston dose of digitalis, because they have seen its action in an animal. They understand the normal functions of the human body better, and are, therefore, entitled to be considered by the physician as an indispensable aide in his service to the patient.

THE INTER-RELATION OF THE DEPARTMENTS OF PHARMACOGNOSY, PHARMACOLOGY AND CHEMISTRY.

Editor's Note: Education should not come in separate "packages" wrapped and labeled, chemistry, pharmacy, pharmacology, etc., because all of these subjects are inter-dependent and should dovetail with each other. This dovetailing cannot be successfully done without an effort on the part of the instructors. Professor Christensen points the way for such coöperative efforts.—C. B. JORDAN.

BY B. V. CHRISTENSEN.*

Inasmuch as this paper is to be presented before a group of teachers of chemistry it is presumed that you will be interested in a few suggestions pertaining to the chemical training of students deemed desirable by teachers of pharmacognosy and pharmacology. The suggestions offered herewith relate more particularly to the nature rather than the scope of chemical knowledge which teachers of pharmacognosy and pharmacology consider essential as aids to a proper understanding and appreciation of these subjects by students. As a matter of fact, if you would

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permit a criticism, I would say that your weakness lies in quality rather than quantity. However, inasmuch as the writer is not a chemist, this discussion is not to be considered a critical review of the teaching of chemistry. It is intended only to offer a few suggestions as to the nature of the chemical knowledge which is of particular value to students in acquiring an understanding and appreciation of the subject matter of pharmacognosy and pharmacology. No attempt is made herewith to classify chemistry under its various subdivisions such as inorganic, organic, physical, etc., and especially in view of the fact that some of the suggestions offered might apply to all or any one of the various subdivisions.

INTERPRETATION OF CHEMICAL LANGUAGE.

First and foremost, we should like to have students well trained in the reading of and interpretation of chemical language. A chemical equation, for instance, is a statement of a chemical fact or theory. As a matter of fact, in many cases a chemical equation is a paragraph or a page of information to those who know how to read and interpret. Take, for instance, the simple equation, $NaOH + HCl = NaCl + H_2O$. If this is true, it tells us that one molecule of sodium hydroxide will combine with one molecule of hydrochloric acid to form one molecule of salt and one molecule of water. It also tells us that 40 Gm. of sodium hydroxide will combine with 36.5 Gm. of hydrochloric acid to form 58.5 Gm. of salt and 18 Gm. of water. We might use Mg or pounds or tons in the same proportion. Again it may tell us that the valence of chlorine is one, of oxygen two, of sodium one and so on. This is simple, of course, but illustrates the point in mind.

A chemical formula also should convey considerable information to a student. From it he should be able to classify the compound as an alcohol, aldehyde, alkaloid or whatever it may be. He should also be able to predict stability and reactivity and, the nature of compounds formed as a result of the reaction, *i. e.*, he should be able to predict polymerization, addition or substitution. He should be able to predict at what point the reaction might occur and thus suggest possible new compounds and the nature of such as for instance, the barbiturates.

We expect students to know at least the elementary principles of nomenclature so that they will recognize the same substances under different chemical names and so that from a given formula they may derive a correct chemical name. This also applies to ide, ate, ite, ic and us endings. We expect also that students know enough about isomerism to appreciate why it is that two substances may have the same empirical formula and yet differ as to physical properties and physiological action.

From the above viewpoint we might compare chemistry to a new language, and proficiency in chemistry, therefore, depends to a large extent upon the quality and scope of the chemical vocabulary of the student.

NATURE OF SUBSTANCES.

Second, we should like to have students come to us well informed as to the nature of substances. They should appreciate thoroughly that substances are recognized and differentiated by means of their properties, both physical and chemical. Students should have clear and definite knowledge as to the meaning and significance of specific gravity, melting point, boiling point, solubility, optical rotation,

refraction, etc. When he is told that the specific gravity of a substance is 2.3 at 4° C., he should be able to determine the weight of a given volume of that substance. When given weight and volume, he should be able to determine specific gravity and when given specific gravity and weight he should be able to determine volume. We expect students to know the nature of such substances as fats, fixed oils, carbohydrates, glucosides and gums. I mention these particularly for the reason that in my experience these have offered the greatest difficulties. It is not enough for students to know that fixed oils are made up fundamentally of glycerides of fatty acids but they should know the nature of the more common glycerides such as olein, linolein, palmitin, etc. Are these glycerides liquids or solids, how do they differ as to consistency, melting point, color and other pertinent properties? If the students know the nature of the more common glycerides, they have less difficulty in understanding and appreciating why we have several fats and fixed oils official and how they differ from each other.

With respect to the nature of substances, qualitative tests should not be overlooked. Students should be trained in the use and application of such tests in recognition and differentiation of substances. Finally, we expect students to be able to make quantitative determinations both gravimetric and volumetric and, in this connection, we suggest that students not only be carefully instructed but drilled on the meaning of the various terms used in connection with volumetric solutions, such as normal, tenth-normal, half-normal, etc., and considerable practice be required in preparing and standardizing such solutions.

PROCESSES.

Third and last, we expect students to have a knowledge of processes. For instance, students should be proficient in performance of the various processes used in determining specific gravity for the several types of substances such as those insoluble in and heavier than water, insoluble in and lighter than water, substances soluble in water and for which some other liquid must be used, liquids, powdered or granular substances and so on. We expect them to know how to determine melting point, boiling point, optical rotation and solubility. Again, students should be able to purify substances by crystallization or sublimation or fractional distillation or by selected solvents. They should understand the differences between direct steam distillation, indirect steam distillation, destructive distillation, fractional distillation, distillation under reduced pressure and the principles underlying each process.

In closing allow me to state that I appreciate the fact that you are not teaching your students fundamentally for the purpose of preparing them for pharmacognosy and pharmacology. However, it does appear that you are training your students for future needs, some of which occur during their college life. Hence, if the students need the foundation in chemistry outlined above, it seems logical that their courses in chemistry should include such instruction both as to character and scope of information. Let me remind you again, that as far as pharmacognosy and pharmacology are concerned, it is desirable to emphasize quality rather than quantity of chemical information.

Eighty-second annual meeting of AMERICAN PHARMACEUTICAL ASSOCIATION and dedication of the American Institute of Pharmacy during week of May 7th. See Transportation under department "Societies and Colleges."