THE TEACHING OF MANUFACTURING PHARMACY.

BY H. G. DEKAY.*

The purpose of this paper is to give aid to the teaching of manufacturing pharmacy. The term "manufacture" is defined by Webster as "The process or operation of making wares or any material products by hand, by machinery or by other agency." The term "manufacturing" is applied to that process "pertaining to manufacture."

Content of the course may be easily gleaned from the material covered in several courses in our pharmacy curriculum. The course given at Purdue University School of Pharmacy will be used as an example of what is being done with one of this type.

According to a survey of "The Four-Year Course in Pharmacy" by DeKay and Lee (1), an effort was made to determine what courses were included in pharmacy curricula. It was found that 14 of the 20 schools included in this survey were teaching a course which it was felt should be classified as manufacturing pharmacy. These courses ranged from no lecture to $1^1/_2$ hours per week per year, while the laboratory ranged from $1^1/_2$ to 9 hours per week per year.

It does not seem probable that a course in manipulative or operative pharmacy could be taught adequately with less than one hour per week lecture and more than $1^1/_2$ hours per week laboratory for an entire school year.

In the survey, "The Four-Year Course in Pharmacy, II" (2), the same twenty schools were surveyed. It was found that 8 of the 20 schools were teaching a course which could be arbitrarily classified as manufacturing pharmacy, with the lectures ranging from none to 2 hours per week per year, and the laboratory from 2 to 4 hours per week per year.

The course in manufacturing pharmacy is taught to the third-year pharmacy students at Purdue University. It is alternated with a course in Practice Dispensing, and is therefore given each semester to one-half of the Junior Class. Its prerequisites are:

> One year of each of the following: Materia medica, beginning chemistry, analytical chemistry and organic chemistry. It consists of two hours lecture and six hours of laboratory per week for one semester. It is devised primarily to acquaint the student with quantity production with and without the aid of machinery. It teaches the student that products of the type manufactured, can be made by the pharmacist in his drug store.

The course in manufacturing pharmacy can be advantageously used in schools that have a dispensary or apothecary shop. In the School of Pharmacy at Purdue University, the Student Health Service renders medical aid to the student body and all prescriptions are compounded and filled in the Apothecary Shop of the School of Pharmacy. The total prescriptions dispensed will range between 14,000 and 16,000 annually. There is a great variety of manufactured materials required to aid in filling this number of prescriptions. The material must be made in large quantities and the manufacturing class has a very important part to play in this undertaking.

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In order to give a brief idea of the type and quantity of preparations that are being manufactured and dispensed, the following table shows the number of each class of preparations and the total quantity prepared during the past two years.

TABLE I.

Type of Preparation.	1934–1935. Number Made.	1934–1935. Quantity Manufactured.	1935–1936. Number Made.	1935–1936. Quantity Manufactured.
Capsules	1	15,000	2	50,000
Elixirs	8	132 liters	8	193 liters
Emulsions	2	28 liters	2	16 liters
Fluidextracts	3	4 liters	2	4 liters
Hair Preparations	1	12 liters	2	14 liters
Liniments	1	10 liters	5	62 liters
Lotions	3	34 liters	7	86 liters
Magmas	2	58 liters	2	25 liters
Mixtures	2	15 liters	2	34 liters
Mouth Preparations	3	302 liters	4	316 liters
Nose Preparations	1	22 liters	2	28 liters
Ointments	10	147 pounds	12	182 pounds
Powders	2	19 pounds	5	104 pounds
Solutions	3	33 liters	6	22 liters
Spirits	4	10 liters	4	16 liters
Syrups	7	249 liters	7	495 liters
Tablets	0	.....	5	98,000
Tinctures	9	47 liters	10	60 liters
Waters	3	16 liters	7	61 liters

A careful study of this table shows that the work of production embraces a variety of preparations which are commonly found in the drug store. A large number of the official United States Pharmacopœia and National Formulary preparations are being made and dispensed.

The production work is carried on under strict supervision, one instructor working with six or seven students. The preparations are carefully checked, stored and studied before they are sent to the Apothecary for dispensing. All comments and notations as to the finished product are carefully recorded in the book used for production. This added supervision gives the student a fuller realization of his responsibility to himself, the school and the student body.

The student has been made familiar with the preparation of small quantities which is a carry-over from his first or second year's work in pharmacy. In this course he is confronted with new problems and is required to call upon his training and initiative to aid him in the preparations of quart, half-gallon or gallon quantities. He no longer prepares one or two ounces of an ointment but makes it in one-pound to five-pound lots. His previous training in the manufacture of tablets has been limited but in this course he is required to prepare quantities of 1000 to 5000 at a time. He is required to review, rebuild and correlate his previous training and acquires new sensations, ideas, responsibilities and techniques in this new field of pharmacy.

The student is given an assignment and work sheet and it is his job to turn out the finished product. Using tablet manufacture as an example, it is necessary for him to first use his pharmaceutical arithmetic to increase his formula to the proper proportions. He then weighs out the necessary ingredients and mixes them

thoroughly, after which the mixture is moistened and granulated. It is then forced through the proper sieves, dried and compressed in the tablet machine. Every process is similar to those commonly used by the manufacturer of compressed tablets.

The finished product is recorded and when the written order is received from the Apothecary, it is promptly checked, recorded and filled by the student, who in turn delivers it to the dispensing room. Every opportunity is used to make this course as practical as possible so that the student can compare his products with those on the market.

This work is therefore a new and varied field for the student. His latent abilities are brought out in his pride of doing something different and worth while. What student does not get a thrill out of showing his products to his parents and friends? He has gained an incentive to carry-on and continues with zeal a course which may have untold fertile fields for him with an opportunity of making it a future profession.

The student is given a problem assignment for his term report. It is necessary for him to use the library and become acquainted with the work that has been done on his subject. It is true that the library has been at his disposal during his previous training, but at this time it becomes a necessary tool for him to use. He is given special instruction in the use of the library by the librarian who shows him how to use the card index files and find the particular reference which he is seeking. He is taught how to make a bibliography and to record the data found in his references. The knowledge gained by this assignment is not entirely confined to this course. The attention of the individual is often diverted to additional interesting items found in the journals or textbooks, which he is bound to consult.

AIDS IN TEACHING.

(1) The course in manufacturing pharmacy can be made to have an appeal for the student that few subjects possess. There is no one who has not felt a responsibility and pride in completing something worth while. This type of appeal will bring out the best qualities and abilities of the student because in previous work his preparations have been kept a short time and then discarded.

(2) A second aid in the teaching of such a course is to stress the importance of accuracy and technique in the manufacturing process. Every school of pharmacy has some form of drug assay or control. Where could an instructor find better samples for control work than those which have been prepared by the students themselves? If one knows that his work is checked and must meet certain standards, he is apt to think twice before slighting some phase of the work. If the control work is regulated and the compounder is required to explain any discrepancies in his finished product, the individual will undoubtedly tend to become more accurate in his work.

(3) The creative attitude and the urge of curiosity have always played a part in the educational process and these characteristics are stressed in this work. His problem assignment gives him the tool by which he can become efficient. After the foundation has been laid and the necessary knowledge gained, it is his problem to do some laboratory experimentation.

(4) The demerit system can be used effectively in work of this type because neatness, cleanliness and accuracy are essential to its success. If a student receives demerits for errors, unclean apparatus and working space, it soon becomes apparent what students are failing to do good work. The demerit system used embraces four major points, namely: (1) Neatness; (2) skill; (3) finished products; and (4) mistakes made in preparation.

(5) What student does not become interested in learning more about how to make new preparations and build new formulas? If there is a possibility of a new product, the work takes on new interest because of that creative spirit which is predominant in all of us. The production of new formulas has been satisfactorily used in our laboratory. The physicians in charge of the Student Health Service request a preparation for some particular use. The instructors are consulted and a careful check is made of those preparations which have been used for this purpose. Students can then be encouraged to work on new formulas and oftentimes new products are obtained having merit.

There are many aids in teaching this subject which could be suggested that can be used effectively. We are interested in new ideas and aids, but wherever the latent abilities of the students can be used effectively, then part of our teaching work has been a success, and the course will become more interesting to both student and instructor.

REFERENCES.

(1) *Proceedings A. A. C. P.*, page 39 (1929).
(2) *Ibid.*, page 49 (1935).

MINIMUM EQUIPMENT FOR ESTONIAN PHARMACISTS.

BY OSCAR LODDY.*

In recent years a number of state boards of pharmacy of this Union have made attempts to prescribe the minimum equipment for drug stores. In each case the required equipment usually has been limited to a few most essential things, such as prescription balance and weights, graduates, funnels, pill tile and spatulas.

It is interesting and instructive to compare our minimum equipment with that of Estonian pharmacies, the most progressive in Europe. Hereunder is the inventory of the minimum equipment and apparatus to be maintained by all the drug stores of Estonia, as per decree promulgated by the Department of Pharmacy of the government and reprinted in December 1937, issue of *Pharmacia:*

1 Distilled water still
1 Tincture press
1 Prescription scale and weights
1 Counter scale and weights
3 Hand scales and weights
1 Burner (Gas or otherwise)
1 Water-bath
1 Steam sterilizer
2 Percolators
1 Complex sieve
1 Pill machine
1 Cachet filler
1 Capsule filler
1 Alcohol lamp
Aerometers for estimating sp. gr.
Test-tubes and rack
1 10X Magnifier
1 Tripod

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