8. Eight Tests for Urinary Albumin.
9. Quantitative Examination of Urine for Urea:

1. By Hypobromite Method. 2. By Urease Method.

Ammonia:

1. By Schiff-Malfatti Method. 2. By Aeration Method.

Chlorides:

1. By Mohr's Method. 2. By Arnold-Volhard's Method.

10. Total Sulphates. Total Solids. Total Acidity (by Folin's Method). Ethereal Sulphates.
11. Qualitative and Quantitative Examination of a Sample of Pathological Urine for: Blood, Bile, Acetone, Sugar, Albumin, Diacetic Acid, Total Acidity, Indican, Chlorides, Urea, Uric Acid, Total Solids, Total Nitrogen.
12. Collection and Preservation of Specimens—Refrigeration; Toluene, Chloroform, Thymol, etc.
13. Clarification and Decolorization of Specimens: Talcum, Pumice Stone, Magnesium Carbonate, Lead Acetate, Potassium Permanganate, etc.
14. The Form of Report. 15. Questions and Problems.

EXAMINATION IN URINALYSIS FOR PHARMACY STUDENTS.

1. Outline the normal urine picture.
2. What is the significance of a 24-hour urinary output of 4000 cc. with a specific gravity of 1.035? 3. Calculate the total solids in the above sample.
4. How would you definitely detect glucose in a sample of urine?
5. Briefly give three tests for urinary albumin.
6. What is the composition of: Esbach's Reagent? Benedict's Solution? Obermayer's Reagent? Fehling's Reagent?
7. How could you determine the amount of urea in urine?
8. Give a test for bile in the urine. 9. How would you clarify a turbid urine?
10. Give the test for urinary indican, and the chemistry involved.

Those who sit for these lectures, who work in the laboratory on many samples, and who pass successfully the examinations given at the end of the course, are fit, we believe, to begin a more advanced excursion into the field of clinical chemistry.

Although we may have been unduly negligent of our responsibilities, there comes to us a great comfort, even in our feeling of uncertainty as to the real value of our efforts in teaching a depised and rejected subject.

Comes to us the poignant realization that on the front lines of the public health defensive, there are young men and women working quietly and efficiently in the hospital laboratories in the service of medicine as it ministers to the needs of an underhospitalized and underprivileged minority. These servants of the national health received some little training in urinalysis at our hands. Our task in teaching goes on.

COMMENTS ON PAPER BY PROFESSOR ANTOINE E. GREENE ON "TEACHING URINALYSIS TO STUDENTS OF PHARMACY."

BY LOUIS GERSHENFELD.*

It is difficult to offer a critical discussion of instruction of the kind you have just received from Professor Greene. To do justice to the subject would require more time than is at our disposal. It is, however, possible to offer certain suggestions and even to ask a question or two in the hope of all of us receiving more instruction.

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I have been and am deeply interested in the subject which has been reviewed. The retail pharmacist to-day falls into several classes. In a rural and suburban store, the pharmacist must have a knowledge of horticulture, agriculture, first aid; and he serves best if he is capable of assisting the medical practitioner at all times, and this includes service as a laboratory technician. In small hospitals, pharmacists are frequently required to help as technicians in the laboratory. There are those students in pharmacy who after the first few years of study enjoy and therefore feel that they are especially qualified in laboratory work, and prefer to train themselves along these lines. Even in urban stores, especially where professional pharmacy is practiced, the clinical laboratory and especially the accurate performance of urinalyses can be of great service to pharmacy and the medical practitioner. In brief, we must admit that this is an age of specialization, and the pharmacy student who at the end of his career wants to be qualified for certain duties which fit in with the practice of pharmacy should be granted that privilege. Our courses in pharmacy must meet the demands of such branches of study as fit in with the practice of professional pharmacy, and elective courses in the curricula will help this situation very much. I am in full accord with the suggestion of Professor Greene that urinalyses be an acceptable elective and if possible a required subject of study, and preferably fortified by other commonly performed clinical laboratory tests. This will fit in with the Applied Bacteriology and Public Health Studies, which are required subjects as outlined in the Pharmaceutical Syllabus, fourth edition. We find, of course, listed in the latter Bio-chemistry, which is included as an optional subject and herein is to be found a consideration of excretions including urine. It is much more desirable to arrange for a thorough course in urinalysis and other clinical laboratory methods. At our own institution we are giving the latter as a required subject.

Professor Greene's comment is well taken that pharmacists should be prepared to dispense diagnostic reagents. These may be requested by the practitioner, who does his own laboratory work; and in some instances the laity may make inquiries for such preparations. It is not uncommon to find diabetics (especially those using insulin) testing their own samples of urine qualitatively for sugar, having received this instruction from their own medical attendants. Such patients don't understand why pharmacists cannot supply Benedict's solution or other reagents. How many drug stores stock litmus paper frequently requested by customers? Many instances could be cited where contacts with medical practitioners were made due to the pharmacist's ability in supplying a diagnostic reagent.

Professor Greene states that "It is the purpose of the course to ground the student in the chemical examination of urine and to do that well." And he further states: "Time does not permit any extensive consideration of microscopic or bacteriological urinalysis." Inasmuch as the title of this paper is "Teaching Urinalysis to Students of Pharmacy," it seems to me that it is important to direct attention to the fact that a careful microscopic study must be made a part of this instruction, and as much emphasis should be made upon the value of the microscopic findings as upon the chemical findings. A bacteriological examination is conducted only occasionally but a microscopic examination is and must be at all times part of a routine urinalysis. Despite a most careful chemical examination with or without the finding of abnormal (chemical) constituents, a correct interpretation of these chemical findings or the possibility of such urinalyses serving as an aid in diagnosis or prognosis may also necessitate microscopical laboratory aid. A careful microscopic examination should be part of every routine examination and in my own observation and experience, I have found that it is most desirable to give the chemical and microscopical instruction either at the same time or during the same semester. If possible, the same instructor may handle both phases of this study, or if need be the microscopical and chemical departments may cooperate. Even in many of the medical schools, there is a lack of proper coördination in the instruction as it is presented when the chemical and microscopic examinations of urine are given to the undergraduates. There may even be too much emphasis given to the chemical examination or too little to the microscopic examination. Frequently the medical student is not in a position to learn the interpretation of the combined findings until he is assigned to the laboratory during his internship. In some measure this may account for the fact that entirely too many practitioners who do their own urinalyses merely do the chemical examination and do not carry out a microscopical examination, even though many of them have microscopes. Many examples could be cited to illustrate the above points. There may be albumin found in the sample. This may or may not be of marked significance depending upon the microscopical findings. It is a frequent

occurrence during the warm weather to find samples in transit and not properly preserved revealing an abundant quantity of bacteria, most of which developed after the collection of the sample. During transit, it is possible for sufficient albumin to be extracted from the abundant growth of bacteria to give a positive chemical test for albumin. Also there are several chemical entities recognized microscopically by their characteristic type of crystals. Uric acid, triple phosphates, calcium oxalate, leucine, tyrosine and cystine are examples of some crystals which are revealed microscopically and are not detected chemically in urine as tests are not conducted for these in the routine chemical examination. We have fallen into the habit of speaking about the chemical test for blood, but you all know that it is in reality a chemical test for hemoglobin; so that this chemical test does not reveal whether we are dealing with a hemoglobinuria (only hemoglobin in the urine) or a hematuria (whole blood in the urine). The latter denotes a pathological condition of the genito-urinary tract, while a hemoglobinuria is in most instances the result of abnormalities outside of the genito-urinary tract. Whole blood (as found in hematuria) will be revealed not only by a positive chemical test (for hemoglobin), but also by the finding of unruptured red corpuscles microscopically. Pus cells, casts, mucus and other organized cellular elements and evidences indicating disease of the urinary tract may be found upon microscopic examination, when a chemical examination may reveal no abnormalities. Let us remember that if there is some faulty arrangement in the instruction and in the lack of the coördination of the various phases of urinalyses as given to medical students, the latter have the added advantage of additional training in a hospital during internship. The pharmacy student does not have and may not receive this added advantage and we who are responsible for seeing that such students are in a position to aid the medical practitioner must be assured that they will do so to the maximum degree.

I agree with Professor Greene that the worker must only report and not attempt to interpret laboratory findings. But at the same time he must be possessed of a rich fund of knowledge not so much to aid in interpreting the findings or to give information as to collection, preservation, etc., when such assistance and information are requested by the practitioner (who makes available other facts which are needed), but mainly because of the fact that the laboratory worker will be in a more favorable position to apply such better judgment in reading the findings revealed after the performance of the laboratory tests.

I think we all agree that it is a difficult task to include all data concerning urine in any course. At the same time an orderly arrangement of the whole subject should be maintained. Though many techniques should be given for the qualitative and even quantitative examination of various constituents, the instructor should point out the relative value of the different procedures and the practical importance of the knowledge resulting therefrom. There are many techniques used in hospital laboratories or by Insurance Company examiners when testing samples of urine that are satisfactory for clinical purposes but which would not answer for research study. Yet these are the methods of choice in clinical laboratory practice and it is advisable to consider them. May I add a few additional notations to the outline of Professor Greene on the course as suggested by him, the inclusion of which will be helpful:

1. A consideration of the frequency of urination and volume voided and factors influencing the latter.
2. It is assumed, I believe, that the physical examination is to include a consideration of transparency and sediments; odor; coloration and pigments; reaction; specific gravity; and the methods employed to report these findings.
3. Mention is made of tests for urinary albumin. This I assume is to include also a consideration of Bence-Jones protein and proteoses, nucleoprotein, etc.
4. Tests for Bile are to include methods for Bile Pigments and Bile Acid Salts.
5. Mention should be made of the Diazo Substance and the Diazo Reaction, a test still requested by some.
6. Detection of Inorganic Metallic Poisons in Urine as arsenic, lead, mercury, etc., should be included as this is becoming of greater significance in pathological conditions.
7. A consideration of tests for kidney function should be given, especially mentioning the technique of the Phthalein or Vital Red Test, as frequently the samples of urine are sent to the laboratory worker who is requested to determine the quantity of phenolsulphonephthalein eliminated.