and uncalled for injustice," should be carefully investigated before being endorsed by the Committee or the Association. Such an investigation might show that the charges so recorded are based on *ex parte* statements, and are either without foundation or are seriously misrepresentative. Such unfounded charges are being systematically circulated, and in a way to appear sincere and truthful, thereby misleading the well-meaning. That the tendency above-quoted, exists, I am not denying, but I think that the greatest care should be taken in sifting specific charges, lest unjust conclusions should be drawn.

2. I think there must be some mistake about a Henbane that contained 0.234 percent of alkaloid. I think something else than the henbane must have been examined, probably Stramonium.

3. I think that something else than Belladonna leaf was examined when 0.099 percent of alkaloid was obtained, probably henbane. H. H. RUSBY.

Memorandum:—In signing this report I do not endorse the unverified charges made on pages one and two. The charges are rather serious and, if correct, should be verified by reference to publication or otherwise. Bald, general statements of this character can not be productive of good. I fully agree with the Chairman of the Committee that if anyone has been injured by error due to an inadvertence of the analyst, restitution to the fullest should be made. No manufacturer should be compelled to suffer loss of trade and be put to an expense as the cause of such error. Respectfully,

L. F. KEBLER,

Chief, Drug Division, Bureau of Chemistry, U. S. Department of Agriculture.

THE NEW SCIENCE OF IMMUNOLOGY.

F. E. STEWART, PH. G., M. D.

It is my purpose in this paper to call your attention to the new science of immunology on account of its rapidly growing importance to pharmacy. Biological products, as they are called, are products of immunization and they are used to produce artificial immunity for the prevention and cure of disease, and for diagnostic purposes. They are manufactured by the great pharmaceutical houses and also by physicians for their own use. They are already handled by the pharmacist, and as the new science of immunology develops, the demand for them will increase.Sooner or later, therefore, the science of immunology must occupy a more important place in relation to the educational work of the colleges of pharmacy, and text books must be written suitable for the use of pharmaceutical students.

Objections are strongly urged by some against teaching the science of immunology in colleges of pharmacy. It is said with some truth that the preliminary education of the pharmacist is not sufficient either in scope or character for him to comprehend it. Attention is called to the fact that the science of immunology deals with knowledge profound and complex, requiring a thorough medical education and post-graduate laboratory training for proficiency. The same objections might be as well urged against the teaching of chemistry in the pharmaceutical schools.

It is also objected that the practical application of the knowledge of immun-

ology pertains exclusively to physicians and bacteriologists, and has no place in the drug-store. On the contrary, a certain amount of knowledge of this science is requisite to proper living and every graduate of a high school should be instructed in the principles of this science.

The conception of contagion or the communication of disease from person to person by contact, direct or indirect, has been handed down from the times of Aristotle (384-322 B. C.) but it is only within recent years that the true nature of contagion has become known. Now we know that the infectious diseases are caused by bacteria, protozoa, yeasts and moulds. The pharmacist is being taught something about these organisms in his course in botany and bacteriology, but it seems to me that he ought to be taught also how infective agents grow and multiply in the body and produce the groups of symptoms known as infectious diseases. The pharmacist is taught by the pharmaceutical college to know that malaria is due to malarial germ carried by the mosquito and that quinine taken properly as a medicine will kill the malarial germ. Why should he not be taught that boils are due to staphylococcic infection, and that the injection of killed cultures of the staphylococcus into the patient's healthy tissues will stimulate the tissue cells to produce substances, which, taken into the circulation and carried to the diseased tissues, will aid in curing the boils?

It is common knowledge that immunity to subsequent attacks of the same disease is conferred by the first attack in relation to some of the infectious diseases, such for example as smallpox or typhoid fever. But how many pharmacists stop to consider how immunity is acquired by the attack of an infectious disease? It is quite generally known that persons subject to "common colds" seem to acquire a greater susceptibility as the result of an attack. Yet bacterins are used for the purpose of immunizing against "colds." How can a bacterin, consisting of a modified disease virus, produce immunity against an infectious disease like a "cold" or influenza, when no immunity can be acquired by an attack of the disease? This question is frequently asked by physicians and intelligent laymen. How can this seeming paradox be explained, or is the use of bacterins for immunization against "colds" a fake? It is also commonly known that immunity to certain infectious diseases may be acquired artificially by vaccination, but how many pharmacists know that vaccines are modified disease viruses or how immunity is produced by vaccination? Infectious diseases: what are they? Immunity: what is it? Unless the pharmacist can answer these questions satisfactorily to the intelligent laymen, he is in position to make himself ridiculous.

But you say the pharmacist is not supposed to be proficient in the knowledge of the uses of drugs. This knowledge is necessary to prescribing medicine, but prescribing is the province of the doctor. That is very true. Prescribing or applying medicine is the province of the doctor, because to prescribe properly, diagnosis is necessary. But no diagnosis is involved in answering questions as to the proper use of a drug. There is a long distance between the knowledge of drugs and their uses, and the knowledge of disease, diagnosis and treatment. Knowledge of drugs and their uses is constantly demanded of the pharmacist by the medical profession as well as by the general public, and in my opinion such

knowledge should be taught in the colleges of pharmacy, so that pharmacists may be able to answer questions asked of them by intelligent laymen and also frequently asked by physicians.

Moreover, the knowledge of immunology is now being popularized by our monthly magazines, weeklies and daily newspapers. The well-educated layman is often far better posted on the subject than either the ordinary physician or the pharmacist. And yet the pharmacist, as well as the physician, claims to be an expert in materia medica. Can the colleges of pharmacy afford to graduate their students without sufficient knowledge of this new science of immunology to enable their graduates to answer questions on the subject liable to be asked them at any time by the educated class of the community?

Most educators will admit that pharmacists ought to be taught how biological products are produced and how they should be carried in stock in such manner as to prevent their deterioration. Yet this knowledge is not sufficient to meet the requirements of the medical profession and the public. If pharmacists are to receive recognition as professional men, they must acquire sufficient knowledge to justify the classification of pharmacy among the learned professions. I am therefore bringing the subject before you for discussion. The following outline is suggested as suitable for use by colleges of pharmacy in teaching the new science of immunology.

OUTLINE SUGGESTED AS SUITABLE FOR USE BY COLLEGES OF PHARMACY IN TEACHING THE NEW SCIENCE OF IMMUNOLOGY.

I. Introduction: General Remarks defining the new science of immunology.

II. History of the Conception and Development of the Germ Theory of Infectious Diseases.

1. Reference to the work and observations of Kircher in 1659, and Leeuwenhoek in 1675. Animalcula. Microbes.

2. Statement of the germ theory by Plenciz in Vienna in 1762.

3. Advancement of the knowledge of infection along the lines of fermentation. Observations and work of Robert Boyle (1627-91); Cagniard-Latour (1835); Schwann (1837); Helmholtz (1843). Pasteur's announcements in 1858, 1860, and 1863.

4. Origin of Microbial Life. Doctrine of spontaneous generation overturned by Pasteur.

5. First actual demonstration of the germ theory; discovery of the microbe origin of anthrax or splenic fever; Fuch's discovery of micro-organism in animals dead of anthrax, in 1848. Henle's postulates for testing the claims of discoverers. Pollender's discovery of rod-shaped bodies in the blood and spleen of animals dead of anthrax, about 1850. Davaine's demonstration that the disease can be transmitted by these germs.

5. Modern conception that infectious diseases are groups of reactive symptoms produced by the resistance of the body cells to invading microbial cells, and that the process is one in which enzymes or digestive ferments, secreted by both combatants, play a most important part.

7. Discovery of the germ of relapsing fever by Obermeir in 1868. Halt in the development of further knowledge in the field of bacteriology and immunology owing to the want of proper *technique.*

8. Introduction of technical methods of research by Koch in 1880, and new era in the development of bacteriology and immunology. Work and observations of Koch, Metchnikoff, Ehrlich, Eberth, Klebs, Behring, Roux, and many others.

9. Great work of Pasteur in developing the knowledge of infection, immunity, and vaccination, stimulated by discovery of smallpox vaccination by Jenner in 1798.

III. Infection and Immunity.

1. Infection and Immunity defined. Natural and acquired immunity. Active and passive immunity. Theories of immunity; Pasteur's Exhaustion Theory; Chauveau's Noxious Retention Theory; Metchnikoff's Phagocytosis Theory; Vaughan's Parenteral Digestion Theory; Theories of Besredka and Garbat and Meyer; Sajous' Internal Secretions Theory; Ehrlich's Side-chain theory.

2. The known infective agents—bacteria, protozoa, yeast and moulds. How infective agents grow and multiply in the body. Protoplasm and protoplasmic enzyme action. Phagocytosis or cell digestion. The doctrine of specificity. Constitution of enzymes. Function of amboceptor and complement. Parenteral digestion. Digestive power of blood serum.

3. How immunity is acquired through an attack of an infectious disease. Definition of term "infectious disease." Infectious diseases due to the growth and multiplication of infective agents in the body. Infective agents live on tissue proteins. The tissue proteins are digested and split up by the enzymes of the infective agents. Structure of the protein molecule; primary (poisonous) and secondary (non-poisonous) groups of atoms comprising the protein molecule. Protein sensitizers. Toxicity of infectious diseases and poisonous action of infective agents due to the poisonous group of the protein molecule. "Serum sickness and anaphylaxis."

4. Immune Serums and Antibodies. Antigens and antibodies defined. Antibodies found in immune serums; bactericidins, bacteriolysins, opsonins, agglutinins, precipitins. Amboceptor or substance sensibilisatrice; immune body. Complement, alexin or cytase. Teachings of various authors compared.

5. How active immunity may be artificially acquired.

(a) Active immunity acquired by immunizing with a living virus.

(b) Active immunity acquired by immunizing with a modified living virus; Vaccination. Smallpox vaccine. Rabies vaccine.

(c) Active immunity acquired by immunizing with killed bacteria; bacterial vaccines.

(d) Active immunity acquired by immunizing with sensitized bacteria; sensitized bacterial vaccines, senso-bacterins, sero-bacterins.

(e) Active immunity acquired by immunizing with bacterial extracts; aggressions.

6. How passive immunity may be acquired.

Antitoxins and antibacterial serums.

IV. Vaccines, Bacterins, Antitoxins, Antibacterial Serums.

1. Preparation. Preparation of smallpox vaccine. Preparation of rabies vaccine. Preparation of bacterins (bacterial vaccines.) Preparation of sensitized bacterins (senso-bacterins.) Preparation of antitoxins and antibacterial serums.

V. Prophylactic Immunization against Infectious Diseases.

1. Active and passive immunization against typhoid fever; paratyphoid fever; influenza and "common colds;" pneumonia; pertussis or whooping-cough; scarlet

fever; Asiatic cholera; bubonic plague; cerebrospinal meningitis; tetanus; anthrax.

VI. Bacterin and Serum Therapy.

The aim of bacterin and serum therapy, the production of a condition of immunity for therapeutic purposes. What occurs in spontaneous recovery. Mechanism of Immunity. Bacterin and serum therapy depend upon the principles of active and passive immunization respectively.

Bacterin and serum therapy of diphtheria; tetanus; typhoid fever; pneumonia; broncho-pneumonia; influenza bronchitis and "common colds;" pertussis (whooping-cough); Asiatic cholera; plague; dysentery; tuberculosis; meningitis; staphylococcic infections, acne, carbuncle, furunculosis, sycosis; streptococcic infections, septicemia, erysipelas, puerperal fever, streptococcic sore throat, rheumatism and various complications; gonococcic infection, acute and chronic gonorrhoea, gonorrheal rheumatism, etc.

VII. The toxins of the Higher Plants and Animals and their antibodies. The phytotoxins, ricin, abrin, crotin. The zoötoxins, phrynolysin (toad poison), arachnolysin (spider poison), snake poison, scorpion poison, bee poison. Antiferments.

VIII. Chemotherapy; distinguished from pharmacotherapy by Ehrlich. Atoxyl, Salvarsan. Chemotherapy of malignant tumors.

IX. Diagnostic Tests and Reactions.

Tuberculin reactions; the subcutaneous reaction, cutaneous reaction, Moro's tuberculin ointment, Von Pirquet's cutaneous test, intradermal tuberculin test, the opthalmo reaction, the mallein test, agglutination tests, Abderhalden's test and various tests by other authors. The opsonic index.

GLYCERITE OF BISMUTH.

WILBUR L. SCOVILLE, PH. G.

The present formula for making Glycerite of Bismuth, N. F., is faulty in that a considerable loss of bismuth occurs in the process and the glycerite is therefore indefinite in strength.

No method for assay nor standard of strength is appended, and thus any product made according to the formula will be approved, but in the use of this glycerite for making elixir of bismuth and similar preparations there will be necessarily a variation in strength.

In preparing the bismuth and sodium tartrate, the subnitrate is first dissolved in nitric acid and water, the solution is diluted, then tartaric acid and sodium bicarbonate are added successively, which probably results in the formation of bismuthyl-sodium tartrate. Whatever the composition of this salt, it is soluble to a considerable extent in the strongly acid liquor, and is not wholly thrown out by further dilution.

Dr. E. H. Squibb has recommended to increase the dilution from 1000 Cc. of added water to 5000 Cc. This throws out the bismuth salt more completely,