Pharmaceutical education and legislation should go hand in hand, to the end that the interests of pharmaceutical education may be promoted, pharmaceutical legislation made more effective, and public service improved.

SUGGESTIONS ON PHARMACEUTICAL RESEARCH.*

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Research may be defined as a seeking after facts or principles, or a searching after truth. What is a fact or principle, or what is a truth? Facts are unalterably fixed whereas a truth is a mere mental attitude. Facts are objective and outside of mind. A truth is subjective, mentally generated and as variable as are mental cerebrations. That which is a truth to one may not be a truth to another, and a truth is not necessarily in harmony with the fact. For example, we are inclined to accept as truth that two and two make four, but is it necessarily a fact? There are learned scholars who are ready and willing to argue the question. That vaccination prevents small-pox is a demonstrated fact, yet there are thousands upon thousands of apparently sane people, some of them laying claim to scholarly attainments, who refuse to accept the fact as a truth. Cancer is a fact, tuberculosis is a fact, gravitation is a fact, war is a fact. What are the truths concerning these facts? Opinions have been uttered from time to time regarding facts of many kinds, many of them in the nature of truths (in the sense that they were subjective convictions which were acceptable to many, or to the majority), which in the light of later observations proved that they were not in harmony with the actual facts. It is no doubt clear that true research is and should be directed toward the disclosing or baring of facts rather than a searching after truths, for investigations pertaining to so-called truths are in the very nature of things primarily prompted by prejudice, either for or against the presumptive truth. To illustrate, universal gravitation appears to be a fact and we have accepted as truth that universal gravitation is some form of energy which is inherent in matter, or one with matter. Is this generally accepted truth one with the actual facts in the case? The proper manner in which to proceed in the investigation of this question is to seek directly after the facts of universal gravitation, and not to search for evidence which might either sustain or refute the generally accepted theory of universal gravitation. As to the disease known as cancer, the existence of which all will admit to be fact, we earnestly pray for a cure. Should the primary research be in the direction of the cure? The logical procedure would be to find the cause, then the cure will naturally follow. We might accidentally stumble upon the cure, as we have done in the case of small-pox, of syphilis and of yellow fever. It is true that we may accidentally hit upon the cure without having located the cause definitely, as in the case of the diseases just named, but a rational plan for any research or investigation should be directed toward the revealing or disclosing of facts.

Who may seek after facts or first principles? The logical conclusion which all must reach is that there can be no disbarment. Any and all are inalienably privileged to disclose facts. Right at this point we meet with confusion. Who shall

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say what is the truth about a fact, since truth is wholly subjective and a mere mental attitude? Shall all have an equal right to declare truths? Shall, for example, the farmer have an equal right or privilege with the eminent bacteriologist to declare truths about Asiatic cholera? Shall the eminent statesman have an equal privilege with the great chemists to state truths about molecules? Indeed, it is generally declared that the utterance of truths is an inherent human privilege which is not to be denied anyone, and as a result we are at times compelled to listen to some very grotesque statements. Even though a truth is declared and freely subscribed to by a vast majo ity, it may nevertheless be far removed from the actual facts in the case. Witchcraft was once vehemently declared to be truth by the majority, but the majority were evidently in the wrong. Our libraries contain thousands upon thousands of tomes devoted to the exposition of truths, rather than to the setting forth of facts, with the result that the seeking mind often becomes greatly confused. Only the mind of unusual discernment is able to recognize scattering grains of fact which lie hidden in the enormous mountain of chaff which is self-styled the truth. Fortunately, scientific endeavor is more inclined toward a disclosing of facts than to an exposition of truths, and hence correspondingly less likely to error and confusion.

As is known to all, there are facts and facts. Some are admittedly important and others appear to us quite unimportant. There are many facts the importance or significance of which is as yet not apparent to us, and not knowing how important they may be we feel no special urge to disclose them. There is, no doubt, absolute unanimity in the thought that research should be directed toward useful ends, but the concept useful, like the concept truth, is again subjective and hence as variable as are the individual human minds. There are, however, some ideas regarding utilitarianism in which nearly all will concur, as for example a desire to be freed from disease, to enjoy good health, to be free from pain, to live to a good ripe age, to enjoy peace and prosperity, and many others. There are also many things which are recognized as desirable by perhaps the majority, but which may be entirely beyond that which is practically attainable. There are also many things which may appear attainable but which are wholly impracticable. Who shall decide what is desirable and what is practical and practically attainable?

We hear it said of this one, "He is well educated, but he is not practical," and of that one, "He is practical, but is lacking in education." The impractical man is so whether educated or not. Education does not make a man impractical, nor does the lack of education make him practical. In fact there are more impractical ignoramuses than there are impractical university graduates, due to the fact that the naturally practical man is more likely to realize the value and importance of learning. It is desired to call attention to that which is impractical in our educational system, irrespective of the naturally practical or impractical tendencies in those who seek after knowledge. No one will deny that our educational system is doing incalculable good.

Nevertheless, certain defects exist and it certainly can do us no harm to call attention to some of them. Attention has been called to the impractical side of education from time to time. Paracelsus, the great alchemist, was bitterly opposed to the academic system of his time, declaring that it did more harm than good.

Others took up the work of educational reform, resulting in changes for the better. The most urgently needed reform is in the graduate courses of the university, embodying the so-called original research work. There is a strong tendency to imitate the European universities, without even comprehending the ulterior aims and purposes of the foreign universities. There appears to be no good reason why we should ape foreign universities.

After a student has diligently prepared himself to do some piece of original work, as at the completion of the university undergraduate course, there is no reason why he should not take up some research work which will prove of benefit to mankind. Why should he waste time and energy in an effort to determine the probable function of the directive spheres in the egg-cell of the lily, or worry over the detailed structure of the nuclear spindle, etc. There is too much astronomical, mathematical and literary research. It is no doubt interesting to know of the behavior of a certain comet that we will never see again; it excites our envy to see a mathematician manipulate complex algebraic formulae, and we may be astounded at the erudite interpretation of some sentence from Browning or from Fichte or Hegel; but what is the practical gain therefrom? Of what avail is all this to the mother who sees her child in the throes of some fatal malady for which medicine has no cure, or to the man shipwrecked in mid-ocean or lost in some dreary desert, or to the cancer patient, or to the patient in the last stage of consumption? Would it not be wiser to devote our best energies to the improvement of human well-being? Let the purely theoretical investigations, the mere display of intellectual skill, the mere internally evolved theorizations and suppositions rest until we have found a remedy for human sufferings, defections, human want and woe. As long as we fail to prevent the terrific loss of life due to disease and warfare, due to starvation and accident, and as long as unhappiness, if not actual misery, is the rule, rather than the exception, there is no time to waste in an effort to determine the limitations of the ego and the non-ego, the types of limb structure of the triassic ichthyosauria, the probabilities concerning the Martian canals, theories regarding the evolution of the simple curve, the probable velocity of stars, the origin and duration of the Umlaut in Germanic languages, evidence proving that Shakespeare did not write his own plays, etc. Researches of this sort may amuse and interest some and thus add their iota toward maintaining the gaiety of nations, but not the remotest lasting benefit can result therefrom as far as the alleviation of human want and suffering is concerned. In the wholly practical research hinted at above, our range of pure knowledge will be evidenced much more than through the pursuit of purely theoretical and impracticable investigations, and we shall, furthermore, have the all-satisfying feeling that we have been of some benefit to mankind.

From the foregoing statements it is not to be concluded that a university training is necessary to do research or to accomplish good deeds. It does not even follow that the good that may be done is proportional to the educational qualifications. Some of our greatest benefactors were almost illiterate. Nor must it be concluded that the practical aim and end of research work should be clearly discernible in advance. The successful outcome of a bit of research work may be purely conjectural or may appear even quite impossible; nevertheless, it should be undertaken with a practically utilitarian aim in view, and continued until it is

demonstrated satisfactorily that it can or cannot be accomplished.

All will agree that some of the researches of the past which have been carried out to final conclusions have been of great benefit to mankind and some have been wholly useless, while yet others have been a detriment and hindrance to human progress. The discoverers of the cure for diphtheria, of the prevention of smallpox and of malaria, and of the carrier of yellow fever, are one and all great benefactors. The discovery of the fossilized remains of long extinct plants and animals is interesting but of no intrinsic value. The inventors of death-dealing implements of war are not entitled to high honor. He who will discover the cause and the cure for cancer will be hailed as the greatest of human benefactors. He who will discover the source of universal gravitation or the ultimate structure of the atom, will unquestionably be called the greatest discoverer of the age, and yet he may not be a great benefactor. A statesman might be such a past-master in the art of Machiavellianism as to embroil nations in a war which will destroy millions of lives, sink yet other untold millions into unutterable misery, and set back the wheels of progress for hundreds of years; and yet, there are some who would hesitate in applying to him the title of great statesman.

We are certainly warranted in declaring that research in order to be deserving must be utilitarian in its aim and purpose, and should comply with the following requirements:

1. It must be directed toward good to mankind as a whole.
2. It must be based upon the fullest knowledge obtainable of such related researches as may already have been carried on by others.
3. It must be in harmony with good judgment and sound reasoning.
4. It must be suited to the ability and equipment of the investigator.

The following suggestions are offered which are to serve as a basis for the development of research in pharmacy and in the related sciences:

A. Create a committee or council to be known as the American Council of Pharmaceutical Research, which shall direct the research work in pharmacy in the United States and shall give suggestions and advice relative thereto. There shall be seven members appointed to the council and each member shall serve seven years, excepting that the appointment to the first council shall be made in such manner that the members will serve 1, 2, 3, 4, 5, 6, and 7 years, respectively. Each year thereafter one new member shall be appointed from the list of eligibles.

B. Qualifications for membership in the council shall be based upon a rating to be deduced from the following attainments. There shall be no age limit to membership.

1. Academic standing, represented by degrees from recognized colleges and universities, American and foreign. Honorary degrees shall not be considered in the rating.
2. Scientific and literary attainments, which are grouped as follows:
   a. Special contributions to pharmacy and the related sciences.
   b. General contributions to pharmacy and the related sciences which may be considered of special merit.
   c. Abstracts and compilations shall not be considered.
   d. Translations of special value to the science of pharmacy shall have the same weight as b.
3. Special activities.
   a. Research work accomplished, representing progress in pharmacy and in the related sciences and which may or may not have been published.
   b. Investigations and research work engaged upon, with or without published preliminary reports.
   c. Plan or plans for future research. Such plans must be fully and clearly stated.

4. Special attainments and accomplishments.

a. Languages, especially German and French.

b. Other languages, as Chinese, Hindu, Arabian, etc.

c. Travels and expeditions in the interest of pharmacy and the related sciences.

d. Membership in scientific bodies and organizations of recognized standing. Honorary membership in such organizations shall not be taken into consideration.

The rating values of the qualifications enumerated above and tabulated shall be as follows:

(1) Shall have a value not to exceed 35 per cent.

(2) Shall have a value not to exceed 35 per cent., distributed as follows:

a. Shall not exceed 25 per cent.

b or d. Shall not exceed 10 per cent. each.

(3) Shall not exceed 20 per cent., distributed as follows:

a. Shall not exceed 12 per cent.

b. Shall not exceed 6 per cent.

c. Shall not exceed 2 per cent.

(4) Shall not exceed 10 per cent., giving a value of 2 per cent. to each qualification or attainment, as the case may be.

The total rating shall not exceed 100 per cent., and each candidate must receive a rating of not less than 75 per cent., in order to be eligible to membership in the council.

C. The first council shall be appointed as follows: A committee from the American Conference of Pharmaceutical Faculties shall prepare a list of American pharmacists having the qualifications set forth above and the seven persons having the highest ratings shall constitute the first council with a time service as follows:

One member to serve one year.
One member to serve two years.
One member to serve three years.
One member to serve four years.
One member to serve five years.
One member to serve six years.
One member to serve seven years.

D. The council thus appointed shall effect an organization and apportion as best they may all such work and duties as may suggest themselves. Each year thereafter one new member shall be appointed from the list of eligibles, said appointment to be made by the council itself. The conference shall determine who shall be eligible.

E. It is intended that the council shall serve as a nucleus out of which shall be created the "American Academy of Pharmacy," membership in which shall be based upon qualifications similar to those required for membership in the council. The Academy may have an associate membership with less severe membership qualifications.

F. An essential to the success of the plan of pharmaceutical research is a publication for purposes of propaganda, and in which the various research articles may be from time to time published. No definite plan regarding a suitable official organ can be submitted at this time. The following suggestions are submitted for consideration and discussion.

a. Arrangements by which the JOURNAL OF THE AMERICAN PHARMACEUTICAL ASSOCIATION might be used as the official organ.

b. Enlargement of the *Proceedings* of the Conference to include the work of the Research Council and the research reports which may be submitted during the year.

c. Revival of the *Pharmaceutical Archives* and development of this into the official organ of the council and finally also of the proposed Academy of Pharmacy.

d. Establishment of a new journal, a quarterly bulletin or an annual report, for the time being, the cost of which is to be defrayed by the Conference. To this end the membership in the Conference might be increased.

The following suggestions on the grouping and distribution of research work are offered, hoping that they may indicate what practical results it is hoped to accomplish. The suggestions apply to those branches of pharmaceutical science concerning which the writer has some knowledge, leaving it to others to suggest research problems in other branches of pharmacy.

A. Research problems which may be undertaken by students in colleges which have the necessary equipment. Each problem assigned must be checked and rechecked by the student with the help of the instructor, until there can be no doubt as to the results and conclusions. The instructor must be held responsible for the accuracy of the work done by the student.

a. Qualitative methods of microanalysis of drugs and of related substances. A student should not attempt more than one or two problems, as the work must be completed before he finishes his college course.

b. Quantitative methods of microanalysis of drugs and of related substances. The student should not attempt more than one problem.

c. Ash determinations (total and acid insoluble) of absolutely pure average commercial samples. One student might complete six such determinations.

d. Drug assaying (chemical). A student should not attempt more than from three to five such problems.

e. Seed germination tests of drug plants which may be cultivated in the United States. Seed treatment to hasten germination, etc.

f. Adulteration of vegetable drugs, spices, insect powders. Samples to be obtained in the open market, retail and wholesale.

g. Composition of dusting powders, and face powders, obtained in the open market.

h. Fineness of powders intended for percolation.

i. Compound vegetable powders, as to composition, purity and quality, correct proportions, etc.

B. Suggested research problems for instructors in colleges of pharmacy.

a. The rate of deterioration of organic compounds, more especially glandular extracts, sera, vaccines and bacterins.

b. Working out a simplified method for determining the efficiency value of disinfectants.

c. The microbic contaminants of pharmaceuticals.

d. The effects of radioactive ores on plant growth.

e. Microbiological root symbiosis of the more important drug plants.

f. The microbial contaminants of face powders, face lotions, toilet preparations, etc.

g. Ultra-filters and ultra-filtration.

h. Allergic skin reactions with a view to determining the following:

Susceptibility to drugs, poisons, bacterial toxins, etc.

Suitable dosage of drugs.

Susceptibility to disease.

Sensitiveness to foods.

Variability in anaphylactic reactions.

i. Useful and practical clinical tests, as

Urine tests for tuberculosis.

Urine test for typhoid, etc.

j. Ultra-violet rays in the sterilization of liquid medicaments.

k. Problems in the cultivation of drug plants.

l. An endless series of problems suggest themselves in the domain of colloidal chemistry.

m. Drug store sanitation problems, with a view to the formulation of rules and regulations in prescription work and in pharmaceutical manufacture.

n. Numerical limits for the microbial contaminations of pharmaceuticals, and methods for determining such limits.

o. Soda fountain troubles. Diseases of soda fountain syrups, etc.

The suggestions above are submitted with the hope that the beginnings will be made in creating an interest in pharmaceutical research and that something may be done to systematize and regulate such work.*

* Action on report:—Chairman, A.C.P.F. Research Committee to coöperate with other research committees to bring about the formation of some institute, such as suggested by Dr. Schneider. That the Research Committee be directed to continue the line of enlargement of research as outlined, relating to subjects for research.