afford to try out a problem that is purely speculative, but a student needs a more safe investment. Secondly, though the instructor is convinced that the problem can be solved, it must offer some chance for the student's own initiative, must give him some play of ideas; it should involve the preparation of specimens, of the performance of experiments which he can carry out himself so that he can be gaining the concept of the essentials of experimental science, which are the formulation of ideas, the development of plans to put them to the test, and then observation, records and analysis. Thirdly, an ideal problem for a student must open up a field for him for further work so that he will get the best thing out of research, a training in a concept of knowledge as a growing thing. With these points in mind, it will be evident that joint research between teacher and student has certain disadvantages for the student that can only be overcome provided the instructor is frank in discussion of its dangers and alive to the idea of giving the student a well-rounded training. The advantages to the student of solving a problem during his medical course are threefold. First, he receives valuable training and gains a new standard of work. Many times I have seen the quality of all the work of a student raised as the result of his training. Second, it enables the student to analyze his own abilities and tendencies from his actual experience. Third, it opens to him the door of opportunity in case he finds that he is actually interested in research and teaching.

From what I have said, it will be obvious that I should make each teacher entirely free in the matter of the training of students in research. This freedom would of course include taking no students, some or all. To make a place in a university for the work of a Willard Gibbs, whether he takes some students or none, whether his work is understood in his day or not, is the great reward of freedom in education. But from the standpoint of the development of medical science, I should judge a school that gave no opportunity for students to start in research as not carrying the full load of the modern university. With the question as to the most fruitful way of meeting the problem of introducing students into medical science, whether by starting every student with a problem and selecting the best or by trying to select those best suited to research and giving them more intensive training, I should let the results be the judge. But, in my opinion, it will not be the method that will be the decisive factor but the individual teacher; given a Ludwig, a Mall or a Welch on the faculty, the question of research will take care of itself. Find the teacher with the gift for stimulating students toward research and give him freedom; he will determine his own method.

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DISCUSSION OF DR. SABIN'S PAPER

I HAVE had a rather unusual opportunity to see how such a plan as outlined by Dr. Sabin would work. For a number of years I taught classes in which were her research students, and there is no question but that the enthusiasm produced by their work with her was of great value to them and stimulating to the other students. Certainly there is a very great chance for the student to gain an experience and to develop a scientific critique which will be of value to him throughout the remainder of his life.

There is an obvious corollary to this discussion which might be mentioned and that is that there should be experienced and active investigators in all medical schools. I think it is not too optimistic to hope that each teacher of medical students will be an active investigator in the field in which he is teaching. I believe that a teacher not engaged in active investigation can not give the student what the student deserves.

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RESEARCH IN LAW

IF one examines existing university law schools he will find that even the best of them have down to date been chiefly professional training schools for those who expect to practice at the bar. A few have arranged to give the members of their faculties a teaching load light enough to permit them to engage in research and writing. None have purported to do much in the way of training legal investigators, except in so far as they have claimed that the pursuit of the regular professional curriculum does so. It must be confessed that the notion that the curriculum does accomplish this purpose is widespread among law teachers, although, as will be pointed out later, nothing could be more unfounded. In addition, the work which students of high standing are expected to do in editing such periodicals as the Columbia and Harvard *Law Reviews* and the *Yale Law Journal* is supposed to give the privileged few who are chosen to the editorial board an adequate training in legal research.

To complete our survey of present conditions we need to add that in recent years a few of the schools —they can be counted almost on the fingers of one hand—have offered a year of graduate work in addition to the regular three-year law school course, and

in this year have permitted and encouraged, but not as a rule required, candidates for advanced law degrees to do what has been called "legal research."

If now we examine into what is meant by research we find that it consists almost entirely in a painstaking collection by the one doing the research of a large number of the decisions of the courts within the field under consideration, and the attempt to piece these together into some general propositions which are conceived to be a statement of the existing law.

Probably at this point it should be said for the benefit of those of my hearers who are not trained in the law that by far the larger part of our law is so-called "common law." Its rules and principles have been worked out through the centuries by the English and American judges, and are not derived from statutes passed by the legislative bodies. The accepted legal theory is that we in America inherited from the mother country—England—a body of "common law" which we have ever since been "applying" to new situations as they presented themselves for adjudication. In developing and applying these rules and principles the courts of the several states have each had a practically free hand, as the common law has in theory been adopted not by the federal government but by each state separately. It is common knowledge that there has thus arisen great diversity of view in the different states as to how given rules or principles apply to new situations, so that to-day, so far as the actual decisions go, the particular common law of New York differs in many important respects from that of, say Massachusetts or New Jersey. There is, so to speak, a strong family resemblance between the systems of rules and principles applied in each of the states, but differences of detail abound. This result, of course, is not surprising to those who understand the logical limitations of all those generalizations which we are in the habit of calling rules and principles.

The attempt of the legal investigator in America to reduce to a coherent system the confused mass of precedents gathered from nearly a half hundred independent jurisdictions, each with a court of last resort to decide what "the common law rule" applicable to each situation is, thus requires him to select from the conflicting views those decisions on a given point which he for some reason or other considers the better, or more sound. Consequently we find the legal investigator and writer not merely setting forth the rules and principles which he regards as "the law," but explaining why he has chosen one rather than another view. This he usually conceives himself able to do without going outside the legal system. That is, he assumes that he can select wisely merely by reasoning about the matter with nothing more to guide him than his knowledge of the cases (including of course the opinions of the courts in which they purport to set forth the reasons for their conclusions), supplemented by whatever slight knowledge of economics or other social sciences he may have chanced to pick up more or less fortuitously.

This method of conducting legal research is apparently based upon a belief that a technique of this kind is adequate for the purpose in view. When we recall that included in the process is a choice between conflicting rules of decision as laid down in the adjudications of a half hundred independent courts of last resort, each of which is entitled to have the last word as to the law within the limits of the state in which it is sitting, we are brought face to face with the question whether indeed this "traditional and known technique" of the common law—as Dean Roscoe Pound calls it—is adequate for the needs of to-day.

This question is the more important as it is at last beginning to dawn upon the more thoughtful members of the community that we are in a period of rather profound social and economic change. The development of new techniques of transportation and of the production and distribution of goods, with the consequent mobilization, so to speak, of the world's population, is producing great changes in the structure of the social order. Especially in America the bringing together of heterogeneous groups of people with widely varying behavior patterns is causing profound alterations in outlook, so that old rules of law adapted to an earlier and far simpler civilization are no longer functioning with efficiency. It is obvious that in such a period the changes in the social and economic order must be reflected in an increasing uncertainty in the legal rules, as, whether they will or no, the courts are bound to endeavor to adjust the legal system to the new situation.

If, then, as the present speaker believes, much of the uncertainty in the law of which we hear so much is the inevitable accompaniment of these social changes, it requires no demonstration to show that an attempt to evaluate existing rules of law, to say which line of conflicting decisions of the courts is the better and to outline the path along which new developments in law should proceed, must involve a knowledge of, or at least an honest attempt to find out, why our rules of law do not meet the needs of present-day society, and what changes in them would produce better results. Thus we are led to the conclusion that in order to do worth-while research in law the investigator of the present and the future must be equipped with an orderly and systematic understanding of the structure and functioning of the social and economic order, and can not depend upon

the hit-or-miss knowledge which he has chanced to pick up. He must realize that his own experience has been limited—to one spot on the earth's surface, to membership in one social or economic class, etc.—and that only a wide and searching study will equip him with the necessary insight into the meaning of the life of to-day.

It is unfortunately a fact that most lawyers and even most law teachers are to-day inadequately equipped in this respect, for the obvious reason that even if they are graduates of our better law schools no attempt was made in their school days to furnish the needed information or understanding or to enlist their interest in the task of acquiring it for themselves.

To-day in the law school world we are beginning to hear much of plans for legal research on the part of a very few of the leading law schools. So far only a little has been said about the necessity of training for the work of legal investigation men who will have not only an accurate knowledge of the legal rules but also an adequate foundation in scientific method and in the other social sciences. The law schools can not act on the supposition that adequate training in these other fields has been acquired in existing colleges before the students enter the law school. Observation for many years of college graduates entering law schools has shown that only a very small fraction of them—so small as to be negligible—can be expected to possess the type of training called for.

If then in the days to come worth-while, really scientific legal research is to be carried on, it seems clear that a new type of legal curriculum must be devised, in which prospective legal investigators will not merely study the rules of law and the old technique, but will also be given an adequate foundation both in other social sciences and in the technique of scientific investigation. The student beginning the study of law with the avowed purpose of fitting himself for research work should at the outset study the structure and functioning of the existing social and economic order. Also without doubt he should at the very beginning be brought face to face with the problems of methodology. How are words used in reasoning? How do judges and lawyers really think, as distinguished from the way they think they think? What tools are available for use in that thinking? How does scientific technique in the field of the social sciences differ, if indeed it does differ, from that in the so-called exact sciences? How does the technique of research in law differ from, let us say, that in economics? All these and other related problems should be raised at the start and answered, so far as that can be done, so that the student may bring the discussion to bear on all his other work. It is also quite possible—indeed I for one think it quite probable—that for the purposes of study the various rules of law should be entirely rearranged in new groupings. To-day in the regulation law school curriculum the arrangement of topics is according to the nature of the rules as legal institutions—contracts, torts, property, agency, etc.—without regard to the part they play in regulating human conduct. It would seem that if the legal rules are thought of—as they should be—as tools, devices which society uses to regulate and promote human conduct, and that if they are to be evaluated from the point of view of their efficiency in promoting ends which we deem proper or desirable, they should be studied from the outset in a way which would bring this out. Since this evaluation can be made only in terms of a thorough understanding of the ends sought to be attained and of the available means of attaining them, it seems obvious that the grouping of the legal rules for the purpose of study should be made from this point of view; that is, the rules should be grouped about the human relations which they regulate and promote, and not, as now, treated merely as legal institutions to be studied, so to speak, *in vacuo*.

The conclusion which we reach, therefore, is that the needs of the present situation can best be met by the devising of an entirely new type of legal curriculum, which will have in view the training of students so that they will possess the necessary scientific equipment for this new type of legal investigation, *viz.*, that of determining how the rules of law are actually working in promoting or retarding, as the case may be, the achievement of desired ends. Legal historians should be trained who would deal with legal history from the same point of view, relating the evolution of the law to the social and economic institutions of the times. If, as I venture to think, most legal history down to date has been of less value than had been hoped, it is because it has been not merely largely antiquarian, satisfying itself with determining the origin of legal rules without following them through their development, but also non-functional, *i.e.*, it has made no attempt to relate the rules to the ends sought to be attained by them.

Whether this new type of curriculum would also serve to train practicing lawyers is another question which can not be discussed upon the present occasion. In passing, however, I venture the confident prediction that it would be found that men trained in the manner suggested would not only practice law far more intelligently than most of the present-day lawyers, but would also be more useful members of the profession in that they would be equipped to render more valuable services in promoting needed legal re-

forms. Be this as it may, the present speaker is convinced that since really scientific legal investigation necessarily involves a study of the functioning of legal rules and principles in society, the traditional professional curriculum as it now exists in the law schools is not adequate for the training of the needed investigators. Indeed, one is justified in saying that the training in the traditional technique and nothing else, as now given in nearly all law schools, even though it follows a so-called liberal college education, is likely to destroy whatever fitness the student had for investigation of the kind demanded, for the reason that it tends to fix ways and modes of thinking which come down to us not merely from the middle ages but from the time of Aristotle; ways and modes which are as yet substantially untouched by the modern scientific outlook upon the world of thought.

There is thus a need that there shall be developed one or more university schools of what, for lack of a better term, we may call "jurisprudence," that is, legal science, with a curriculum avowedly adapted to the training of legal scientists as distinguished from practitioners of law. Above all, the students in such schools of jurisprudence should be given an insight into what a scientific approach to problems in any field is and what it involves, and so an appreciation of the difficulties to be overcome in applying scientific technique to the social sciences and especially to that of the law.

Underlying all that I have said will be found a postulate which has been tacitly assumed and not discussed, *viz.*, that a really scientific study of law, or as I prefer to say, legal phenomena, is possible. Into the justification for making this postulate I can not now go, although if time permitted cogent reasons could be urged for doing so. As it is, we shall have to content ourselves with saying that, unless we make it, all talk about research in law from a scientific standpoint is futile and a waste of time. That at the present moment a real science of law does not exist is obvious; but all that this signifies is that as yet no serious attempt has been made to apply a truly scientific approach to the study of legal problems. We are still in the era when professional philosophers who know almost nothing about law write books about the philosophy of law, just as earlier they wrote about natural philosophy and mental philosophy. These latter topics have now been turned over to the scientists who study physics and chemistry on the one hand and psychology on the other. If indeed the science of psychology is still in its earlier stages, it is because a completely scientific approach has not been achieved. At the present moment, however, psychology seems at last to be fairly on its way to the discovery of a sound scientific method of working. In like manner the dawn of a real science of law will doubtless be heralded by the disappearance of treatises upon the philosophy of law by professional philosophers who know little or no law, and the writing of such books by those who are not scientific experts in the field of legal phenomena will be as rare as the production of works upon the philosophy of medicine or of psychology by those not trained in those fields. Before this time comes, however, we must train a generation of legal scientists, sufficiently grounded in the broadest aspects of their field of study so that they can do worthily the work which the philosophers with inadequate legal training are endeavoring to do to-day. Such men will understand not only the possibilities of the technique they are using but also its limitations. When, and only when, we have a sufficient number of men trained in the manner suggested we shall have a genuine "philosophy" of law, using that term in its broadest sense, for then and only then will it be founded upon an adequate study of all the relevant phenomena by men trained in a sound scientific technique.

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(Concluded in next issue)

COSMIC ASPECTS OF ATMOSPHERIC ELECTRICITY[1]

THERE being as yet no generally accepted theory to account for the origin and maintenance of the earth's negative charge, it is of paramount importance to continue observation and investigation of the laws and modus operandi of the changes to which atmospheric electricity is subject during the day, year, and from year to year. The present paper is confined to a statement of facts applying to the so-called electrically or meteorologically undisturbed days, *i.e.*, to "fine-weather days," or days of no negative potential and no pronounced disturbances. It is only for these days that it has been possible up to the present to deduce world-wide laws. These facts in their generality have received further confirmation since the chief theories regarding the earth's electric charge were proposed.

In one notable respect atmospheric electricity differs from the equally elusive subject, terrestrial magnetism, in that the fluctuations of the atmospheric-electric elements are of the same order of magnitude as the absolute elements themselves—not fractions of a per cent. as is usually the case with the fluctuations of the magnetic elements. Thus, even on an electrically undisturbed day, the potential gradient may

[1] Presented at the Philadelphia meeting of the American Physical Society, December 29, 1926.