difficulties now associated with the proceedings in which medical witnesses are concerned would be considerably lessened. It would be a frank and open discussion of purely medical problems, and would be conducted in the same manner as an ordinary medical consultation on a patient suffering from some obscure and difficult complaint.

Dr. W. Ostermeyer said he would like to express his appreciation of the most able exposition of the manner in which scientific methods were employed in judicial proceedings. Since Bacon's *Introduction to Induction*, the application of science to legal proceedings has exercised the minds of lawyers and logicians. John Stuart Mill read Jeremy Bentham's *Principles of Legislation* in 1825, and he became a changed man. Mill was then in his twentieth year. In 1827, he re-wrote Bentham's *Rationale of Judicial Evidence*, which was the forerunner of his *System of Logic*, published in 1841. In this he laid down that liability involved causality and that science, logic and the law were interrelated. At the same time it had to be admitted that a good scientist may be a very poor scientific assessor, and a very unskilful practitioner. He thought that real tangible results would result from a conference of experts from both sides, as suggested by Mr. Hurley. As a matter of fact, Lord Sankey, according to an article in the *Fortnightly Review* on "New Steps in Legal Reform," laid down that expert assessors could confer and draw up a report which may be agreed to. The present system of giving verdicts on facts partially stated by experts was illogical.

Mr. P. D. Phillips described what occurred in the mind of everybody who began the practice of law. When he leaves the University, the law consists of certainty and justice. Leaving the Law School, his determination is to assist, by a strict application of the law, the justice side of the equation. After a little experience, he realizes that it takes such a long time to find out what the law is, that he gives up the search for justice, and spends his time endeavouring to find out what the law is. Having learnt something about what the law is, he most decidedly is left more uncertain as to what justice is. That discovery leads to the final stage in his development: a stage when he discovers that the justification for a great many things, even after considerable analysis, is unsatisfactory, that he is left with the feeling that his conclusions are unsound and incapable of rational justification. Any justification of the present system for dealing with problems of science, it seemed, would be based on premises:

(1) That the problem to be solved is an artificial one, the law describing the rights of the parties in the suit, and the judge giving his determination of those rights according to definite rules, after hearing permissible evidence of facts. The facts, thus, are limited by a whole series of compendia quite artificial.

(2) That the expert witness shall be competent to give an opinion. That did not suggest, for instance, that the medical witness should only be called and examined after all the facts are deposed, that he had to make up his mind as to the facts. That is the very thing he does not do, and which the system aims at preventing him from doing, and the reason is that if he is a witness, it is incorrect to permit him to engage in a part of the judicial process. The medical witness does not have to determine what are contradictory facts.

(3) The lecture suggested the artificial value of the concept of causality which the law involved. Naturally, the principle of the concept of causality was artificial, and it was one which every lawyer found most difficult to understand. Indeed, every problem is artificial when its solution is limited by legal rules. When the difficulties associated with solving problems under existing procedure are realized, the reasons for the rough and ready suggestions to appoint assessors can be seen. Such a suggestion, however, did not really approach a solution of the legal problem, and one was left with the feeling that there was a great deal to be said for the persistency of the law to accept no change. If the only difficulty to the appointment of assessors was the difficulty with regard to appeals, he felt it was one that could be overcome. When a jury is invited to determine on an issue, what it resolves is sacrosanct; there is no appeal, and nothing can interfere with it. The proceeding before the Admiralty Court in England was different, as Mr. Justice Dixon had explained. At times, an ordinary jury and Judge seemed inadequate to decide finally. A case in point was one in which a question for compensation for pain and suffering was involved. The Judge, in his direction to the jury, had said that money was no compensation for pain and suffering, that in that matter, it would have to do the best it could. The jury, not forgetting that advice, brought in a verdict sufficient to just about cover the medical expenses. Afterwards, Counsel met the foreman, and, mentioning that the damages were very low, asked how they arrived at their assessment. "Well," said the foreman, "the Judge said that money was no compensa-

tion for pain and suffering, so we didn't give her anything for it." Commonly, juries do not reason so logically in arriving at their verdicts.

As a final word on law reform: Is not the time ripe for the appointment of some government advisory body to consider some suitable measure of law reform? It was a matter that intimately appealed to lawyers. Parliament was too busy to give time to initiating the necessary reforms. Let the lawyers, then, undertake the task of suggesting measures to overcome the difficulties. The really learned lawyer was not likely to be iconoclastic. He knew what was required, and if he knew that his views would not be pummelled by Parliament, he could produce something that would be a really workable reform.

Mr. E. Gorman, K.C., said he had not come to the meeting to express any views, but simply as an interested auditor. Really, he had no views to express on the subject discussed, which ranged from the question of expert witnesses to law reform. His complaint regarding expert witnesses was not on account of their quantity, but their quality. From the discussion he realized that there were two classes of experts—one of the legal and the other of the medical profession. There are other experts, but the advice of his profession is to avoid experience of them. He never passed a prominent building in Melbourne without being forcibly reminded of an error in 300,000 bricks. Experts were called in on both sides, and, needless to say, a great majority journeyed to the site of the erection. It was expertly deposed that a mere error of 300,000 bricks was something about which no informed person could impute negligence. The other expert deposed that an error of 300,000 bricks could not be reasonably expected of a qualified architect. The building, however, was otherwise a triumph of scientific and architectural skill, and the Court found for the architect.

He was not able to address the meeting on the high plane of the previous speakers. He was not able to subscribe to the doctrine that the subject of the expert witness warranted minute attention. His uniform advice to clients, when expert witnesses have to be called in, was to get together and settle as quickly as possible. Personally, he had no enthusiasm for experts, and he doubted whether some of the medical profession had. Handwriting experts, despite the cloud under which they were in England, have gained a prominence in this community, and their testimony receives a great deal more attention than their merits entitle it. For the most part, members of the handwriting

profession are recruited from the ranks of retired bank managers over 70 years of age.

He was very sorry for not being able to follow the particularly high level upon which the discussion had proceeded. But did anyone seriously suggest that the expert witness assisted the case? There was the matter of vocabulary employed. At times, this contributed to openings for judicial humour. But surely the medical profession could condescend to use language which is readily understandable by all those associated with the case, from the Judge to the jury. The jargon employed by experts and scientific witnesses may be understandable if intended for Judges alone, but to employ it when discussing matters for the information of juries was quite indefensible. No intelligent man should have to use terms which require translation. It must be recognized that there is in the legal profession, and has been for many years a considerable hiatus between the judiciary and the jury. There was also the question of the expense incurred in the employment of expert witnesses, which only wealthy litigants are able to bear. There had been a suggestion that expert witnesses should be used by the Judges alone. It was one he trusted that those who made it could reconcile with their own consciences. With regard to the appointment of assessors, he did not think that litigants could be satisfied with the results. Under such a system, expert witnesses would probably become assessors, by reason of their frequent appearances in the Courts and the experience thereby gained. Furthermore, there were experts in many professions, and what was given to one profession could not be refused another. It was very surprising to him, and to many others of his profession, to witness a medical expert for the insurance company making a sworn statement that the injured person had made a splendid recovery, and would be completely well in a day or so, while the medical expert for the claimant gave it as his expert opinion that the injured person would not recover during the next seven years. And it was further surprising to see that experts could so readily be found, if the solicitor were sufficiently active to round them up and the client sufficiently willing to pay them.

In connection with medical experts in will cases, he did not think he was over-stating the position when he said that there is a marked inclination for Supreme Court Judges to attach no importance to the evidence of the medical witness. It must be remembered that "the expert witness is one retained to make sworn argument."

Mr. Justice Dixon, in replying upon the matters raised by the discussion, said he would like first to thank Dr. Sewell for informing him and changing his view upon the manner of the death of Charles II. Until that evening, he had always thought that the King displayed a whimsical humour in apologizing to those serving him for the remarkable time when he took for dying. But now, after having heard a recital of the treatment he received of those who attended him, he was inclined to think differently. In the circumstances, it was better that Charles did succumb. He would also like to thank Dr. Ostemeyer for perhaps not changing, but increasing his opinion of John Stuart Mill. He had read of the various changes which John Stuart Mill underwent; how his entire outlook was changed by reading Wordsworth, and the further change which resulted from his marriage, but he was not aware that his contributions to logic which affect us so much was due to his perusal of Jeremy Bentham. But a perusal of John Stuart Mill has caused others to reflect and change their ideas. He often wondered what view of human conduct would be taken by a medical man who judges things from a pathological and not from the merely external standard of experts. The changes which John Stuart Mill underwent, he was convinced, were completely due to some conditions which he experienced. At particular times, he (Mr. Justice Dixon) was conscious of being affected by the explanation of conduct which is quite outside the range of his experience, and he had felt that medical men would have taken an entirely different view from that he had taken. The observation which Mr. Gorman had last made proceeded from an enthusiasm for the cause of right, for which he is so well known in the Courts. His (Mr. Gorman's) own expert knowledge was very great, and lay in several domains, the area of which he had lately been increasing. After listening to Mr. Gorman Mr. Justice Dixon felt disposed to apologize for taking such a favourable view of the medical profession and expert testimony. Consideration of such matters had convinced him rather of the difficulties with which the medical profession are confronted by the law, and by the difficulties with which the law is confronted by expert testimony. The difficulty of the barrister is in the reconciliation of two considerations.

First of all, there was the undesirability of having experts who would willingly give testimony in such a way as not to kill the jaundiced views of those who may give a different opinion, and which he can show with care to be a complete

negation of the truth; witnesses with an ever willingness to supply answers to questions which no human being could be expected to answer. Still, the solution of the problem is the answer to those questions, and of those required to answer them, the Judge sitting in the Court of Appeal is the last. He is required to solve the unsolvable. He made no apology for appearing to defend the expert. Mathematicians who at times appear in Court possessed extraordinary knowledge. Medical evidence seemed to be the most easily obtained, although perhaps it is the most easily disposed of, because most lawyers believe that they have a knowledge of medicine almost equal to the medical man's supposed knowledge of law. That assumption in both cases is largely due to a lack of appreciation of the difficulties which both these involve. Mr. Phillips, in addressing himself to the subject, he was very pleased to observe, drew attention to the most important phase in connection with those difficulties, and the statement he made of the considerations or objects he (Mr. Justice Dixon) had in view was correct. Any society such as that was useful in that difficult questions could be discussed apart from the human equation, consideration being given only to the inherent difficulties in them. Mr. Gorman, speaking from the back of the audience, had reduced the discussion to the requisite level. He would like to say that he was by no means unconscious of the fact that expert evidence, even apart from handwriting, is often of little or no value because it is insincere. He did not think it desirable to discuss that fact. Most oral evidence suffered in a more or less degree from the same criticism. Few man engaged in the ordeal of close cross-examination could admit that they were in a position to give answers which they would have given in their calmer moments, or when under less pressure to preserve a personal interest. That was one of the particular difficulties of the method. Very few litigants are able to go through the entire process of a trial without having lost connection of memory with the direct facts as they actually existed. Of all these things people were perfectly well aware. The best to be done under the circumstances is to hope that the effect is not exaggerated.

Dr. Weigall said that to him had fallen the privilege of moving a vote of thanks to the learned lecturer. He hoped he was not out of order in stating that the lecture, to him, had been a wonderful illustration of what was meant by the judicial mind. To those like himself who were mere listeners it had been an extraordinary revelation of the type

of mentality which all should attempt to follow. Every fact was so complete and separated from and yet part of the preceding and following fact. This made one realize how different was the trained legal mind from the medical mind. With the medical mind, a doctor merely stated "the patient will get better" or "he won't get better." He relied on his opinion deduced from experience of similar cases.

Now we knew from the lecturer's analytical review what was really evidence and what was merely opinion, and it gave some justification for the alleged remark of a Judge to Counsel: "For heaven's sake, sir, get your facts *right* before you attempt to distort them."

It was a matter for appreciation that men such as the lecturer could afford the time to come and occasionally rest among ordinary men, and they were fortunte in having a society which gave opportunity to hear such lectures as they had been privileged to hear that evening.

Dr. T. C. Brennan, K.C., said he had very much pleasure in seconding the vote of thanks which had been moved by Dr. Weigall and he endorsed everything that he said. When His Honour started upon the lecture he said that he did not know whether some lawyers engaged in justifying the ways of the law. No wise man, he contended, attempted to do that; certainly he (Dr. Brennan) had no intention to attempt anything in that direction. But what the lecturer had done with his customary modesty was to justify the way of the law. His Honour taught them the importance of the expression of the judicial mind. He could merely hope that Dr. Weigall had not gathered from what he had heard that night that all judicial minds were the same. If he had, his awakening may not be pleasant. Much His Honour had told them was old and familiar, but he had dealt with his subject with that nice literary touch for which he is well known. As Dr. Weigall had stated, no word had been said which it was not necessary to say. The lecture was a model of clearness and condensation, and he seconded the vote of thanks with pleasure.

THE LAWYER IN SCIENCE

By W. H. Osborne, Professor of Physiology,
University of Melbourne

A Meeting of the Medico-Legal Society was held at the Medical Society Hall on March 17, 1934, at which Professor Osborne delivered an address, his subject being "The Lawyer in Science." The President, Mr. Wilbur Ham, K.C., occupied the chair.

Professor Osborne said: What is the definition of a man of science current in the ranks of men of science? He is one who by his researches has added to our knowledge of natural phenomena. He is essentially a creator. In any description of the phenomenal world pretending to accuracy, there are a large number of unknowns. If a man is able to reduce the number of these unknowns, he is counted a scientist. He who reads and understands but does not contribute and he who, however ably, expounds but does not conduct research, will not be admitted into this category. The general public, and even educational authorities, frequently display ignorance of this essential character and confuse together the true man of science with the popularizer and school teacher. Lord Kelvin, who has been called "the Napoleon of science in the nineteenth century," also "the successor to Newton," was a lamentably poor teacher of the elements of physics and had he been under the control of an Education Department would probably have been dismissed for incompetence. If we compare the state of science as he found it with the state when he left it, then Sir Isaac Newton must be acclaimed as the greatest man of science who has ever lived on this planet. One may well doubt whether the human intellect ever underwent such terrific activity as in the production of the *Principia*. At the present time there are certain physicists who are not above indulging in unchecked speculations, playing to the gallery and writing "best sellers"—they have abandoned the Newtonian tradition, to their lasting shame.

In the world of science one never hears the terms amateur and professional; one hears the terms scientific and unscientific. It matters nothing whether a man earns his bread by his science or labours for love—it is the nature and quality of his work that counts. In every scientific laboratory, particularly in Britain, you will find men of wealth working with determination and grim earnestness alongside those who have been compelled by poor circumstances to accept a paid position. And so we find in the history of science the wealthy Henry Cavendish, scion of a noble house, and Michael Faraday, son of a blacksmith, admitted to the Pantheon of the Great. The debt of science to the unpaid votary is enormous. The law of the conservation of energy and with it a new outlook on the physical universe was given to the world by James Prescott Joule, a wealthy Manchester brewer and Julius Robert Mayer, a German ship's surgeon. Charles Darwin shook the world, not from a University chair, but from a private garden. Amongst those who have made major contributions to science will be found many men engaged in professional work outside the territory of pure science but devoting much thought, time and experiment to genuine scientific research. I propose to deal with this contribution under the headings of the several professions.

The Clerical Profession

The great break with tradition and authority and the inauguration of modern scientific freedom is rightly ascribed to Copernicus (1473-1543). If Copernicus belonged to any profession it was the clerical, though technically he may not have entered into orders. The Church, however, has a good right to claim him as one of her sons. The Jesuit order has produced a long line of brilliant astronomers, physicists and mathematicians, happily still continuing. One of the greatest of these was Boscovich (1711-1787), who attempted a reconciliation between the undulatory and corpuscular hypotheses concerning light. He postulated that atoms were centres of

energy and came surprisingly near to some aspects of modern relativity. The very modern science of experimental genetics dates from Gregor Mendel, Abbot of Brünn (1822-1884).

Coming to the Church of England we find Jeremiah Horrocks (1619-1641), a poor curate in a country town. Horrocks checked the mathematics of the lunar theory and in his analysis of this and of the path of projectiles came very close to Newton. His most striking achievement was the prediction that Venus would pass over the sun's disk on November 24, 1639. The actual phenomenon is not much from the spectacular standpoint, but for the determination of the dimensions of the solar system it is of front-rank importance. Incidentally, it may be mentioned that James Cook was sent out in the *Endeavour* primarily to observe a transit of Venus in Tahiti. Horrocks was alone in his calculation of the 24th of November, 1639. Alas, it was a Sunday and the poor young curate—he was only twenty, was confronted with the decision whether he would observe the sun's disk or perform his clerical duties at his church. He decided to do his duty, which many to-day would regard as quixotic. However, it turned out all right, for in the wintry afternoon as the sun was descending, a small speck appeared on its red disk. This superb mathematical triumph made a profound impression on astronomy. The Rev. Stephen Hales (1677-1761) is honoured as the founder of plant physiology and also as one of the foremost experimenters in animal physiology. I annually repeat Hale's experiment demonstrating arterial blood pressure to my class of medical students. Quite a number of Anglican clergyman have been interested in geology, one of the most noted being the Rev. Thomas George Bonney (1833-1923), whom I had the honour of knowing. Joseph Priestley (1733-1804), the discoverer of oxygen and the inventor of the pneumatic trough, was a Unitarian parson. It is not generally known that he gave the world soda water, which he termed mephitic julep.

The Rev. William Robertson Smith (1846-1894), perhaps

the greatest editor of the *Encyclopædia Britannica*, and a distinguished contributor to anthropology and the mathematical theory of electricity, was a Presbyerian.

The Medical Profession

Galileo (1564-1642) is usually regarded as the fighting apostle for the Copernican theory, but by far his greatest contribution to science was his analysis of the laws of motion. Up to his time and following the Greek tradition, mathematical reasoning had been applied only to statics. Galileo's first discovery, that of the isocronism of the pendulum, was made as a student of medicine and the first application of this discovery was a device for measuring the rate of the human pulse.

The next name of note is William Gilbert (1540-1603), the first experimental physicist in England and a true and great pioneer. Gilbert was a distinguished doctor and was court physician to Elizabeth, but he found time to experiment with loadstones and to him we owe the facts on which the science of magnetism is based. He asserted that the earth itself is a magnet and explained the direction and dip of the magnetic needle. He also gave us the word "electricity." It is amusing to read the attack which Francis Bacon made on Gilbert. He classed him with alchemists and empiricists and warned his readers about this "jumping and flying to generalities." This contemptible attack is worth reading, nevertheless, as its "sound and fury" have quite a modern touch. I leave out William Harvey as his great discovery of the circulation of the blood pertained to his own craft.

My next medical name will be Sir Hans Sloane (1660-1753), who was a distinguished botanist and collector and may be regarded as the founder of the British Museum. Then comes a name reverenced by all men of science, Dr. Thomas Young (1773-1829), the possessor of a remarkable intellect, one of those very rare persons who can be supreme in more than one theatre of effort. He made contributions to philology and was the first to decipher the Egyptian

hieroglyphs. He next turned his attention to the nature of light and in defiance of Newton gave to the world the undulatory theory. So well supported was the theory by experiments, that when recently a return to the Newtonian concept was suggested, so cogent were Young's arguments that a compromise had to be sought. Young then examined the physiology of vision and discovered astigmatism; he proved that focusing is due to alterations in the crystalline lens, and gave the world the trichromatic theory of colour vision which was subsequently established by Helmholtz. He investigated the physics of elasticity and "Young's modulus" remains to-day as a reminder of his greatness. Only four years ago an American physiologist desiring to measure the diameter of blood corpuscles, used the eriometer invented by Young to determine the size of fine fibres. The only department of activity in which Young was not far ahead of his contemporaries was in his profession of physician. He was too scientific for the medicine of that age. He wrote a book on tuberculosis but it is undistinguished. In spite of his outstanding achievements and in spite of his nobility of character Young, was attacked with venomous animosity by the lawyer, Henry Brougham. Here is a specimen of that cruel criticism:

"As this paper contains nothing which deserves the name either of experiment or merit, we should have allowed it to pass among the multitude of those articles which must always find admittance into the collections of a society which is obliged to publish two or three volumes every year. The dignities of the author and the title of Bakerian lecture which is prefixed to this lucubration should now have saved them from a place in the ignoble crowd. But we have lately observed in the physical world a most unaccountable predilection for hypothesis daily gaining ground, and we are mortified to see the Royal Society forgetful of its importance in science to which it owes its origin; and neglecting the precepts of the most illustrious members is now by publication of such papers giving countenance of its high authority to dangerous relaxations

in the principals of physical logic. We wish to raise our feeble voices against innovations that can have no other effect than to check the progress of science and renew all those wild phantoms of the imagination which Boyle and Newton put to flight from her temple. We wish to recall philosophers to the strict and severe methods of investigation pointed out by the transcendent talents of these illustrious men, and the security of their astonishing success."

In connection with Young's hypothesis of interference, the *Edinburgh Review* adds: "The hypothesis which is assumed from fanciful analogy self adopted for its apparent capacity of explaining certain appearances must always be varied as new facts occur, and must be kept alive by the same process of touching and retouching the successive accommodation and adoption to which it originally owed its puny and contemptible existence. But the making of an hypothesis is not the discovery by a doctor. It is a mere supporting of the subject; it is a sham fight which may amuse in the moment of idleness, and relaxation, and will neither gain the victories over prejudice and error nor extend the empire of science. It is the unmanly and unfruitful pleasure of a boyish and prurient imagination or the gratification of a corrupt and depraved appetite. If, however, we condescend to amuse ourselves in this manner, we have the right to demand that the entertainment be of the right sort, and that the hypothesis be so consistent with dates and so applicable to the facts as not to require perpetual amendment and patching; that the child we stoop to play with shall be tolerably healthy and not of the puny sickly nature of Dr. Young's productions, which have scarcely stamina to subsist until the fretful parent has furnished us with a new litter, to make way for which he knocks on the head or more barbarously exposes to the first." Suffice it to say that the name of Thomas Young still lives, while the name of Henry Brougham is one that is a stench and an abomination in science.

Helmholtz (1821-1894) was an army surgeon, then professor of anatomy, then professor of physiology and finally

a pure physicist. His contributions to the mathematics of the new science of energetics have given him a niche in fame alongside Kelvin. He invented the ophthalmoscope which may be regarded as standing next to the stethoscope in diagnostic utility. Julius Robert Mayer (1814-1878) was a ship's surgeon. Whilst in the tropics he noted that blood flowing from a vein was redder than in colder climates. This set him thinking and he was eventually led to formulating the law of the conservation of energy and giving a value to the mechanical equivalent of heat. He then, with fine imagination, applied his discovery to the solar system and to the universe as a whole. As stated, the Manchester brewer, Joule, came at the same time to similar conclusions. Mayer showed that all forms of available energy on this earth have been derived from the sun. Herbert Spencer, in his *First Principles*, gives an excellent summary of Mayer's arguments. In my copy of this book, a secondhand one, a former writer has written the word "bosh" across this very page. I wonder to what calling this critic belonged!

Certain Other Professions

Sir William Herschell (1738-1822), who perfected the reflecting telescope and who, as the greatest astronomer of his age, gave humanity the idea that the Milky Way was a nebula of which our solar system is a very minor constituent, was a professional musician. Another musician gave medicine the laryngoscope. One hardly experts contributions to science from the purely æsthetic but Leonardo da Vinci ranks as an experimentalist. In our own day the views of Samuel Butler have to be taken seriously.

The Legal Profession

One name will occur to many in this connection—Francis Bacon, Lord Verulam (1561-1626). Many literary and legal persons have the idea that to Bacon we owe the rise of modern science. A very little investigation will disclose the fact that he was opposed to the science of the day.

In his *Descriptio Globi Intellectualis* he gives his reasons for not accepting the heliocentric theory in these words: "In the system of Copernicus there are many and grave difficulties: for the three-fold motion with which he encompasses the earth is an inconvenience; and the separation of the sun from the planets with which he has so many affections in common is likewise a harsh step: and the introduction of so many moveable bodies which are peculiarly lucid and radiant; and his making the moon adhere to the earth in a sort of epicycle; and some other things which he assumes are proceedings which mark the man who thinks nothing of introducing visions of any kind into nature provided his calculations turn out well." Draper, in his *Intellectual Development of Europe*, is very scathing. "Few scientific pretenders have made more mistakes than Lord Bacon. He rejected the Copernican System and spoke insultingly of its great author; he undertook to criticize adversely Gilbert's treatise *De Magnete*; he was occupied in the condemnation of any investigation of final causes while Harvey was deducing the circulation of the blood from Aquapendente's discovery of the valves in the veins; he was doubtful whether instruments were of any advantage, while Galileo was investigating the heavens with the telescope. Ignorant himself of every branch of mathematics, he presumed that they were useless in science, but a few years before Newton achieved by their aid his immemorable discoveries. It is time that the sacred name of philosophy should be saved from its long connection with that of one who was a pretender in science, a time-serving politician, an insidious lawyer and a corrupt judge, a treacherous friend, a bad man." This estimate shows temper and not the judicial calm of the historian but Draper's facts are correct. Oliver Lodge gives a more sober criticism. "Of Lord Bacon it is necessary to say something, because many persons are under the impression that to him and his *Novum Organum* the re-awakening of the world and the overthrow of the Aristotelian tradition were mainly due. His influence, however, has been exaggerated.

I am not going to enter into a discussion of the *Novum Organum* and the mechanical methods which he propounded as certain to evolve truth if patiently pursued; for this is what he thought he was doing—giving the world an invariable recipe for discovering truth with which any ordinarily industrious man could make discoveries by means of collection and discrimination of instances. You will take my statement for what it is worth, but I assert this: that many of the methods which Bacon lays down are not those which the experience of mankind has found to be serviceable; nor are they such as a scientific man would have thought of advising. The truth is that Bacon himself made no discoveries and was not strictly speaking a scientific man, yet he exercised a potent influence on the progress of science in these islands by the way in which he cleared the ground and prepared the minds of scholars and men of letters to begin to regard further and unprejudiced inquiry into the facts of nature not only with less repulsion than heretofore, but even to assume a kind of good-natured tolerance. Bacon's lack of the modern scientific instinct must be condemned, but he rendered humanity a powerful service in directing it from books to nature herself and his genius is undubitable." Professor Cajori, in his *History of Physics*, writes of Bacon as follows: "People unacquainted with the history of scientific progress have even imagined that to Francis Bacon and his *Novum Organum* are principally due the re-awakening of the world, the overthrow of the Aristotelian physical philosophy, and the introduction into science of the inductive method. As a matter of fact, Bacon was not a scientific man; he had little practical experience in experimentation; he lacked the scientific instinct to pursue in detail the great truth that nature must be studied directly by observation and experiment. He appears to have rejected the Copernican System and to have treated with contempt the researches of Galileo and Gilbert—the greatest experimentalists of his day. Bacon undertook to give an infallible rule by which anyone could, with perseverance, make scientific discoveries."

Bacon's actual service was to popularize science and to free the experimentalist from the charge of having to do with the black art. As Sir Oliver Lodge has put it, "he made chemistry respectable," and so we find men of social position and of approved orthodoxy joining the ranks of the experimentalists. But he was not himself a man of science and he contributed nothing to science.

The next name is Sir William Robert Grove (1811-1896), lawyer and man of science. He improved the galvanic cell which before the invention of the dynamo gave the most powerful current then obtainable. Unfortunately, it was messy and liberated acrid fumes. His chief contribution to science is his investigation of the different forms of energy and the insight he showed in declaring that they were interchangeable. But he fell short of Joule and Mayer in not giving numerical expression to the equivalence.

Quite a number of lawyers have been brilliant mathematicians but considering their many contacts their contribution to experimental or even deductive science has been very small. Why is this? It is certainly not due to deficient mentality. The man of science admires and generally envies the nimbleness of wit in his lawyer friends. Is it that the man of law is so engrossed in his subject that he cannot give time and thought to scientific work? Hardly this, for legal gentlemen have taken very kindly to politics and literature. Is not the explanation to be found in the fact that the lawyer and man of science work in different regions. Each revolves around his own attracting sun but the orbits do not intersect.

DISCUSSION

Sir James Barrett said that he had listened with a great deal of pleasure to the exposition of Professor Osborne, although he did not find himself in complete agreement with him. First he found himself asking: "What is science?" Is it taking the conclusion of facts, carefully verifying the conclusions emerging from that data and checking them in every way? That is what experiment consists of. But in many departments of knowledge quite as important as science he was convinced it was possible

to take an experimental attitude. In some branches of knowledge it was possbile only to collect facts and come to conclusions. The trouble came of thinking of science as physical science, whereas science could be applied to every occupation of life. There was a large number of men in the professional branches of science, in universities and elsewhere who were specialists and not men of science, because they did not apply the methods of science except to their own professional subject. He had once attended a Royal Society Club in London and every man present except himself had done some important piece of research work, but when those scientists got off their own subject, they were the most unscientific men he had ever come across.

Professor Wood Jones said that even anatomy may be a subject of science, and he showed some old prints to illustrate his point. He was grateful to Professor Osborne and greatly obliged for the number of instances given. It was unfortunate that scientific men should be subjected to uninformed criticism. But what had happened to Harvey and Lister were only passing shadows, although it would surely happen to others. Unfortunately, one of the most difficult results to acquire from education and certainly not the least valuable is educated tolerance.

Mr. Justice Dixon said he had very little to say upon the subject, for as he was a lawyer it was almost completely outside his domain. Among those who practise the law, the expression "lawyer" is used almost habitually to mean a person who does know a good deal about some branch of the law, and it is used to distinguish such persons from those who merely practised at or received education in the subject. He was present one day at a gathering where a distinguished English lawyer was informed that he was expected to take part in entertaining a number of people from Canada and the United States who were coming in the guise of lawyers to visit Great Britain. He asked how many there were, and being told twelve hundred, he said: "There are not twelve in England," and proceeded to count them. When there appeared to be so few, it was difficult to know what change goes on in the human mind in the process of trying to inject that difficult and rather interesting knowledge into the mind. Sir Francis Bacon was not thought of as a lawyer, although his published works contained two or three legal papers. Mention of him was not to be found in legal text-books, unless among the list of Lord Chancellors. He was well and permanently known for other reasons, but notwithstanding that, he was a lawyer

by profession. Of course he was the reputed author of Shakespeare, but even so he was a person not permanent in the minds of lawyers to-day. He stood nowhere on the list among English judges, and his essay, "Of Judicature," although well known by every barrister, is forgotten by judges. Grove was a well-known person in the law and as a judge had the reputation of being a man who understood the scientific witness. Lord Moulton had a great reputation as a scientist and he might have had the reputation of being a great lawyer if he had not specialized. During the war the authorities allowed him to take charge of the dye industry. His biographer represents him as a chemist and has little to say of him as a lawyer. Amongst lawyers he was regarded as a man of great legal knowledge, intolerant habits and a strange disposition. Whether he acquired the intolerant disposition from chemistry or the law he did not know. The result of Professor Osborne's statement was to show that the law, with the exception of Grove, had made no contribution to science. The reason probably lay in the circumstance that law was a branch of knowledge which had nothing to do with natural phenomena and lawyers were not likely to be interested in physical science as they would not have enough knowledge of it to arouse their interest. Besides, by the time the lawyer had acquired an adequate knowledge of law, it was impossible for him to gain knowledge of anything else.

Professor Osborne, in reply, said he was really alarmed when Sir James Barrett uttered his panegyric on the contribution of the lawyer to social well-being, on the important place he occupied in the community and on legal methods generally, but actually this was a defence of something unattacked. Sir James thought lawyers were men of science but that they worked in an unscientific way, and perhaps he was right, for men with very numerical and mathematical minds were known to take up spookism. Still the fact remained that the doctor, the cleric, the musician and members of other professions had contributed to science and the legal profession had not. The reason given by Mr. Justice Dixon was the tremendous amount of work done in another field and Sir James Barrett was pleased to put it down to the lawyer's industry in handling human evidence. Those points having been brought out, the evening had not been misspent.

Mr. Crowther, in moving a vote of thanks to Professor Osborne, said that he rose with considerable trepidation, but he realized that the object of the Society was to provoke

discussion and he was confident that Professor Osborne had done his best in that direction, even though some of the thoughts in the minds of the legal gentlemen present who had been fortunate enough to listen to him, had not been expressed. No doubt the medical gentlemen would extract a great deal of comfort from the address. Nevertheless, Mr. Dooley's advice to always consult a doctor when in trouble if you can, and a lawyer if you must, was still elementarily good, even though some would suggest that it really did not matter so long as you got in touch with a scientist. He entered a humble plea for the claims of British common law to a certain scientific foundation because he would claim that it represented considerable scientific research and application. He had pleasure in thanking Professor Osborne for his address.

Dr. Gerald Weigall said that it also afforded him a great deal of pleasure to second the vote of thanks. It was an extraordinarily interesting lecture, and the meeting was indebted to Professor Osborne for coming along and giving members the advantage of his enormous fund of knowledge and experience.