Sir J. J. Thomson's Seventieth Birthday.

MESSAGES OF CONGRATULATION FROM ABROAD.

Prof. E. P. ADAMS,
Princeton University, N.J.

IT is pleasant to have this opportunity to express the satisfaction I feel in having had the privilege of working in the Cavendish Laboratory under Sir Joseph Thomson. Modern physics owes much to his genius; in fact, modern physics is very largely built upon the work he himself did and the ideas he furnished to the workers in the Cavendish Laboratory. Under his inspiring leadership the Cavendish Laboratory became the dominant centre for physical research, attracting students from all over the world who wished to come under his influence.

In addition to his stimulating interest in all the research carried out in the laboratory, Sir Joseph's lectures contributed much to the influence that the Cavendish Laboratory has exerted upon modern physics. His wonderful facility for making his hearers feel the reality of his point of view made his lectures full of suggestions for further work, and thus they carried out the principal object of lectures, which is to make the hearers think for themselves.

Here in Princeton Sir Joseph is remembered with real affection. For in 1896, at the time of the sesquicentennial of the founding of the College, he came over and lectured on the results of his latest work. He aroused great interest in the new discoveries, and in his belief, rather startling at the time, that electrons are constituents of the chemical atoms. It was largely through his influence that Profs. J. H. Jeans and O. W. Richardson came to Princeton from Cambridge. Prof. Richardson was mainly responsible for building up at Princeton, in the Palmer Physical Laboratory, a school of physical research. This is only one illustration of many that might be given of the way in which the influence of Sir Joseph Thomson has spread out far beyond the Cavendish Laboratory.

Prof. S. J. M. ALLEN,
University of Cincinnati.

If we say that a prophet receives more credit abroad than at home, it is equally true that in estimating the work of a great scientist the opinion of those outside his own country may be of more critical value than even that of his countrymen. This is especially true of Sir J. J. Thomson. To a reputation gained in his own country, and richly deserved, has been added the unstinted admiration of his co-workers in foreign lands, especially in the United States and Canada.

A fertile imagination, and true understanding of the nature of the problem, combined with the finest experimental skill, produced results of the greatest importance, reminding one of the immortal Faraday. His method of subjecting a moving charge to the combined action of electrostatic and magnetic fields, with the resulting determination of e/m, for the electron, and later for the positive ray, made his fame secure, and paved the way for the recent brilliant work of Aston on the isotopes. When the time comes to erect his monument (may it be far distant), perhaps the noblest symbol that could be placed thereon would be "e/m."

The American, or Canadian, who has had the great pleasure and honour of meeting 'J. J.' as director of the Cavendish Laboratory, or as Master of Trinity, carries back with him the remembrance of a great scholar and genial host, and gains through this association a wealth of knowledge and suggestions that are invaluable to him in his future work.

Prof. NIELS BOHR, For.Mem.R.S.,
University Institute of Theoretical Physics, Copenhagen.

It is with great pleasure that I accept the invitation of the editor of NATURE to take part in the universal celebration of the seventieth birthday of Sir J. J. Thomson, to whom every one interested in the problem of the constitution of the atom is so greatly indebted. Not to speak of the leading part he has taken in the discovery of the electron as a common constituent of all atoms, we owe to him an abundance of ideas which have proved fruitful in the attempts to develop a detailed theory of atomic constitution based on this fundamental discovery. At a time when even the existence of atoms was regarded by many prominent scientists with scepticism, Thomson had the courage to venture on an exploration of the inner world of the atom. Guided by his wonderful imagination and leaning on the new discoveries of the cathode rays, Röntgen rays and radioactivity, he opened up an unknown land to science. By following electrical particles and ether-waves on their way through atoms he obtained the first estimate of the number of electrons contained in an atom and of the forces by which they were bound, laying in this way the foundation of that elaborate structure which has been built up in recent years through the joint efforts of a large number of workers. We find in his famous attempt to account for the remarkable periodicity of the physical and chemical properties exhibited by the elements when arranged in the order of their atomic weights, the germ of the ideas characteristic of the modern interpretation of the periodic table. Indeed, it is difficult for scientists of the younger generation, who are working on the new land to which Thomson has opened the gates, fully to realise the magnitude of the task with which the pioneers were confronted.

M. LE DUC DE BROGLIE,
Membre de l'Académie des Sciences, Paris.

Il suffit d'un coup d'œil jeté sur l'histoire scientifique des quarante dernières années pour voir que le développement de la physique moderne, c'est-à-dire de la théorie électronique de la matière a pris naissance quand on a compris en quoi consistait le passage de l'électricité à travers les gaz.

C'est la notion d'ionisation qui a permis d'étudier les rayons X et de découvrir la radioactivité comme c'est elle également qui a mis sur la voie des représentations

actuelles de l'atome, si profondes, si fécondes déjà et si pleines de promesses pour l'avenir.

Or c'est à Sir Joseph Thomson et à ses élèves qu'est due presque entièrement l'interprétation de l'ionisation des gaz, expliquée pas à pas par les physiciens de Cambridge et si objectivement mise en évidence par l'un d'eux, le professeur C. T. R. Wilson.

Aujourd'hui encore le premier livre à mettre entre les mains de celui qui veut s'initier à la physique du vingtième siècle est la "conductibilité électrique des gaz" écrit par le chef et l'animateur du Cavendish Laboratory. Il y a peu de temps, en en voyant une récente édition j'admirais combien la plus ancienne avait été merveilleusement composée pour avoir été si peu modifiée par les travaux des vingt-cinq années les plus actives de la physique électronique. Sir Joseph Thomson avait tracé un cadre si parfait des nouvelles perspectives de la science que les progrès ultérieurs de celle-ci semblent n'avoir été que le développement et l'achèvement des divers chapitres de son ouvrage. La part personnelle prise par l'ancien chef du Cavendish Laboratory, tant au point de vue théorique qu'expérimental dans toute cette partie de la physique, et le couronnement plus récemment apporté par la découverte fondamentale des spectres de masse des corps simples lui vaudront la gloire difficile d'inscrire sans crainte son nom à côté de celui de ses illustres prédécesseurs.

Le titre auquel a droit le très grand savant que l'on honore aujourd'hui est peut-être le plus beau que puisse ambitionner un homme de science et de génie: il a été le guide et le flambeau de toute une génération de physiciens qui portent aujourd'hui les noms les plus illustres de la science actuelle et son influence se fait sentir maintenant sur les élèves de ses élèves.

Toutes les nations du monde envient le Cavendish Laboratory pour son passé comme pour son présent.

Prof. D. F. COMSTOCK,

Massachusetts Institute of Technology, Boston.

On the occasion of Sir Joseph Thomson's seventieth birthday, will you allow one of his old students, who long since strayed from physics into the field of engineering research, to express his congratulations and to acknowledge gratefully a many-sided debt to him?

I went to the Cavendish for the purpose of absorbing, if possible, a little of his vision, a little of his way of looking at problems which were still nebulous; and through his kindly patience with the immaturity of a young student, I absorbed as much of this subtle influence as my capacity would allow. Whatever originality I may have shown through the intervening years is traceable in no small part either to his direct influence at that time or to his writings before or since.

I know that many, who are not primarily physicists, have benefited by this extraordinary power of Sir Joseph's to stimulate the originality of others, and because of this characteristic of his genius, his influence has spread far beyond the confines of pure physics.

I know that I am expressing the feeling of industrial research workers in general when I gratefully acknowledge our obligation to Sir Joseph not only for the new truths of Nature which his researches have uncovered, but also for the subtle stimulus which comes even from his writings and makes research work in any field happier and more successful.

Mme. CURIE,

Radium Institute, Paris.

Sur la demande de M. l'Éditeur de NATURE, il m'est agréable de m'associer à l'hommage rendu par le monde scientifique à M. le Professeur J. J. Thomson dont j'apprécie hautement l'œuvre, aussi bien pour la profondeur et l'originalité des vues théoriques que pour l'important ensemble de recherches expérimentales. Sans essayer d'envisager toute la variété des travaux de Sir J. J. Thomson, je désire rappeler que nous lui devons un grand nombre de résultats fondamentaux relatifs à l'étude des particules chargées, molécules, atomes et électrons. Parmi ces résultats, nous trouvons les premières déterminations de la charge élémentaire et du rapport de la charge à la masse pour l'électron, ainsi que la première notion de la masse électromagnétique. Non moins riches en conséquences sont les recherches de Sir J. J. Thomson sur les rayons positifs et l'interprétation si sûre qu'il en a donnée, conduisant à une nouvelle méthode d'analyse chimique qui est applicable à de très petites quantités de matière et dont on connaît le succès dans la généralisation de la notion de l'isotopie.

Le nom de Sir J. J. Thomson est souvent prononcé dans les laboratoires de physique, plus particulièrement dans ceux qui se consacrent à l'étude des particules portant une charge électrique et à celle de leur mouvement. C'est là un des problèmes qu'on aborde fréquemment dans les laboratoires destinés aux recherches sur les phénomènes radio-actifs—et c'est à ce titre que j'ai plaisir à exprimer à Sir J. J. Thomson ma gratitude pour l'importante contribution scientifique représentée par ses travaux personnels ainsi que par ceux qu'il a inspirés et dirigés.

Prof. GEORGE E. HALE, For.Mem.R.S.,

Mount Wilson Observatory, Pasadena, California.

I have always felt the exceptional stimulus of two great English laboratories, which for generations have maintained positions of leadership because of the men who have worked in them. The Royal Institution, dating from the time of Rumford and Young, is rich in traditions for the astronomer scarcely less than for the physicist. But in these days, when cosmic experiments are so frequently necessary to test the tenets of relativity or the ultimate consequences of theories of matter, we who devote ourselves to astrophysical research perhaps feel an even greater indebtedness to the Cavendish Laboratory. What a lineage of directors it holds before us—Maxwell, Rayleigh, Thomson, Rutherford! Among these we must attribute chiefly to Thomson its advance to an international position as a centre of research.

I remember with special pleasure my frequent visits to Cambridge, in peace and war, and the never-failing inspiration of my talks with Sir Joseph. It has been a great privilege to watch the growth of his ideas and to see the vacuum tube transformed under his hand from a coiled spectacle for the curious to a powerful instrument of research. He was among the first to

explain the presence of charged particles in the sun, and in many other ways he has placed students of astrophysics under obligation. I am personally indebted to his writings for more than one basic suggestion, and I appreciate no less his encouragement during my efforts to extend the use of laboratory methods in astronomical observatories. I am, therefore, pleased to be permitted to join in warm congratulations to Sir Joseph and the Cavendish Laboratory on the occasion of the celebration of his seventieth birthday. I can offer no better wish than that the splendid successes of the past may continue through a long and happy future.

Prof. CHAS. T. KNIPP,

University of Illinois, Urbana.

Sir Joseph Thomson's influence reached the central of the United States during the early 'eighties. I remember distinctly, a decade later, as a pupil in a small county seat high school in north-western Ohio, that our teacher in 'natural philosophy' directed the attention of the class to a possible new theory of the structure of matter proposed by Prof. J. J. Thomson, of the Cavendish Laboratory of physics at Cambridge, England. This reference was to his vortex theory. The story caught the attention of the class, for we all had seen the wonderful smoke rings shoot up from the old style funnel-shaped locomotive stacks. From that time on any reference in the newspapers to Prof. Thomson was eagerly sought, and almost unconsciously I became a great admirer of his ability.

A few years later while in the university, I found this same feeling of respect and admiration shared by those studying in the domains of physics and chemistry. Theories advanced by Thomson formed our topics for discussions. His discovery that the electron carries a negative charge and is a constituent of all matter, his identification of the Edison effect as due to electrons, and his later measurement of the charge and mass of the electron, were accomplishments that promptly received the commendation of American physicists and chemists. He was the leader during this the electron period. Afterwards his great contribution on the study of the properties of the elements by positive ray analysis attracted wide attention in America. Here again he was the pioneer worker and blazed the way for entrance upon the positive electricity or proton period, as it may now be called.

Nor are we in the States unmindful of Sir Joseph Thomson's brilliant conception of atomic structure, in which the various elements are represented as combinations of negative electrons and positive charges arranged as miniature solar systems—a conception that will always stand for the guidance of research on this fundamental problem.

Beginning with 1890, and continuing up to the present, the writings of no one person have had a greater influence upon the research activities in physics in American universities than those of Sir Joseph Thomson. That this statement is correct is attested by the large number of students from there that have sought out the Cavendish Laboratory for the doing of productive research. Personally, it is this high regard for Sir Joseph as a scholar, investigator, and as a gentleman, that impelled my second visit (the present one) to the Cavendish Laboratory, to engage in research and to lay claim, as it were, to his terse and illuminating criticisms and valuable suggestions.

Research in physics and chemistry in the United States owes a debt of gratitude to Sir Joseph Thomson for his marvellous record of nearly fifty years of uninterrupted original contributions. As one of many from across the Atlantic, I humbly add the foregoing as a message of appreciation of the accomplishments of an active and productive personality.

Prof. ALOIS F. KOVARIK,

Yale University, New Haven, Connecticut.

During the past as well as during the present generation, the Cavendish Laboratory has been the Mecca for physicists from all parts of the world, and we Americans owe a debt of gratitude to it for aiding and developing the spirit of research in physics in America. There is scarcely a physicist in America who has not been a pupil of Sir Joseph or else a pupil of one of his pupils. In the case of the latter, the enthusiasm for research and the high esteem for the Master came not only by reflection from those more fortunate ones who had been with the Master himself, but even in some cases with added force, for the powers inherent in his pupils were released by virtue of their contact with him. To these men Sir Joseph was made known not only as a physicist who opened the fields of electronics and of atomic structure, but also as a most congenial and sympathetic man. To them also he soon became simply 'J. J.' They seemed to learn to know him intimately even before meeting him personally on his several welcome visits to America.

Those of us who have been more fortunate and to be privileged to associate with him at one time or another, have had an increasing esteem for him not only because of the great scientific achievements which his mind made possible, but also for those things which a man likes to find in another man. Not only did he show interest in one's scientific work, but also he always showed human interest in the man himself, his friends, and the institutions with which he was connected. We all love his characteristic smile, and every one of us felt a certain pleasure within ourselves on hearing a footstep that every Cavendish man recognises as solely 'J. J.'s.'

It was my good fortune to have been a pupil of two of his pupils and to have experienced the delights from such associations, but at more recent time I had the privilege to be associated with him in the Cavendish and in Trinity—as a guest in both—and it is a pleasure to admit that my love for him, for his human and personal qualities, causes no less pleasure to me than my great admiration for his genius as a physicist.

Prof. PAUL LANGEVIN,

Collège de France, Paris.

J'ai eu la bonne fortune de commencer ma carrière scientifique par un séjour d'une année au Cavendish Laboratory, dans la période où, sous l'impulsion de Sir Joseph Thomson, immédiatement après la découverte des rayons de Röntgen et de la radioactivité,

se constituait cette École de Cambridge dont l'influence a été si grande depuis trente ans sur le développement de la physique moderne.

Le plus charmant souvenir m'est resté de cette époque déjà lointaine depuis laquelle l'importance et la réputation du laboratoire n'ont cessé de grandir. Nous étions une quinzaine de jeunes gens venus de pays bien différents pour mettre en commun l'enthousiasme que leur inspirait la science nouvelle et réunis dans une commune admiration pour le jeune maître dont le rayonnement les avait attirés.

Il y avait là Brown, Child, McClelland, Henderson, Henry, Richardson, Rutherford, Shakespear, Townsend, Vincent, Wade, C. T. R. Wilson, H. A. Wilson, Zeleny. Nous avons eu récemment à déplorer la mort prématurée de McClelland ; celui qui est maintenant Sir Ernest Rutherford est venu diriger un Cavendish Laboratory singulièrement agrandi ; les autres sont dispersés un peu partout dans le monde. J'espère qu'un bon nombre d'entre eux se retrouveront la semaine prochaine à Cambridge pour évoquer des souvenirs et reprendre, autour du maître resté si actif malgré les années, les conversations anciennes qui s'échangeaient à l'heure du thé, dans son cabinet où nous nous réunissions après sa visite quotidienne à chacun de nous.

De cette époque datent les premiers travaux de Sir Joseph Thomson sur les rayons cathodiques et la décharge disruptive. Il commençait cette admirable série d'expériences qui devait aboutir à la découverte de l'électron négatif et à la création de la méthode si féconde des spectres de masse.

Du côté théorique comme du côté expérimental, l'œuvre si personnelle de Sir Joseph n'a fait que grandir en même temps que de plus en plus nombreux ont été ceux qui, chaque année, sont venus s'inspirer de sa parole et de son exemple pour répandre ensuite sa pensée et garder entre eux des liens précieux pour eux-mêmes et pour l'avenir de la science.

Les témoignages de reconnaissance et d'admiration qui viendront vers lui à l'occasion de son soixante-dixième anniversaire montreront à Sir Joseph Thomson combien son action a été grande et combien sont fortes les affections qu'il a su rassembler autour du laboratoire illustré par lui.

Prof. THEODORE LYMAN,

Jefferson Physical Laboratory, Harvard University, Cambridge, Mass.

When I entered the Cavendish Laboratory as a graduate student in the fall of 1901, I found myself in an atmosphere of a stimulating quality which I have never seen equalled in any other place. Not infrequently the influence of a great man upon his time is indirect, but Prof. Thomson not only illuminated the scientific world of the period of which I speak, but also managed to carry his students with him into his own realm of intellectual enthusiasm.

To the majority of us the prosecution of research is a laborious business ; the road is long and steep, blind byways beset us, the perversity of inanimate objects foils us. But those of us who know Sir Joseph Thomson and appreciate his genius are in a position to realise that to one whose mind is attuned to Nature the path of knowledge is neither tortuous nor laborious. The experience gained at the Cavendish remains, even after the lapse of a quarter of a century, a happy memory and a source of lasting inspiration.

Prof. A. A. MICHELSON, For.Mem.R.S.,

Ryerson Physical Laboratory, University of Chicago.

It gives me sincere pleasure to add to the others an expression of my high appreciation of the magnificent work of Sir Joseph Thomson and the influence it has had on the whole field of electronics and radioactivity. No other discovery has so profoundly altered our notions of the ultimate structure of matter. I welcome the opportunity of expressing my most cordial congratulations and best wishes for the continuation of his activities for many decades to come.

Prof. ROBERT A. MILLIKAN,

California Institute of Technology, Pasadena.

It is not merely the group of erstwhile workers in the Cavendish Laboratory who owe to Sir Joseph Thomson the chief inspiration of their scientific careers. I speak for many who have never been students there when I say that no man living has exerted so large an influence upon my own activity in physics as has Sir Joseph. It was his writing which stimulated my entrance in 1903 into the domain of photoelectric research, a domain which has been one of my chief interests ever since. It was he who inspired me so early as 1905 to try to pull electrons out of cold metals by fields alone, a research which led through all the mazes of high vacuum technique, and yielded results of importance in the direction aimed at only after ten years of effort. It was he whom I followed in making cloud experiments when I first observed, and worked with, isolated electrons. It was he who directed the thought of all of us in seeking to build atomic models based on electron configuration. It was he who made the first analysis of space charge effects, who pointed out the existence of mass as a function of electric charge and showed how to compute its value. In a word, it was he who, more than any other one individual, was responsible for formulating, and gaining general acceptance for, the theory of the electronic construction of matter—an idea that is probably to exert larger influence upon the destinies of the race than any other idea which has appeared since Galileo's time.

Prof. VLAD. NOVÁK,

Technical High School, Brno.

Forty years ago little was known of British methods in physics and other natural sciences in the historic lands of Czechoslovakia. Our instructors, having been taught and trained in German schools, followed German methods. The German University of Prague was divided into German and Bohemian schools in sections in 1882. The natural sciences were studied in the Bohemian Philosophical Faculty of the Charles and Ferdinand University of Prague in the first ten

years in buildings so primitive that one of the Austrian ministers himself described them as "a European scandal."

No wonder, then, that our students went to foreign universities! I believe the first of our scientific men who brought us some of the English research method in natural science was Prof. Boh. Brauner, our distinguished chemist, who studied at Owens College, Manchester (1880–82), and is well known to readers of NATURE.

Thirty years ago I had the opportunity to begin some research at Cambridge at the Cavendish under the guidance of Prof. J. J. Thomson. We were about eleven research students, and made quite a family party, meeting every day at tea-time in the professor's room. Prof. Thomson's discourses on these occasions, on the work going on in the laboratory, and his method of investigation, together with his clear and instructive mode of lecturing, his papers and books, made a great impression upon my whole future life. As a private lecturer at the University of Prague, where I trained young teachers in physics, and some years after, as professor of experimental physics at the Technical High School at Brno, I tried to follow my great teacher.

The laboratory work in our physical institutions at Prague and Brno, the spreading of English scientific literature throughout our libraries, our new text-books of physics, for both colleges and high schools, and especially the progress in new editions of books of practical physics, show clearly how we in Czechoslovakia have followed Sir Joseph Thomson's inspiring example.

Twenty years ago my friend Dr. Záviška, professor in the Bohemian University, worked at the Cavendish, and his scientific work and method of teaching through these years are proofs of the inspiring guidance of the great director of the Cavendish Laboratory.

I am very happy to send this modest message of our deepest thanks, and appreciation of Sir Joseph Thomson's influence upon the progress of physical science in our country, on the occasion of the celebration of his seventieth birthday.

Prof. KARL PRZIBRAM,
Radium Institute, Vienna.

While deeply indebted to the editor for giving me the opportunity of joining in the world-wide chorus of congratulation in the columns of NATURE, I should feel abashed if it were not possible for me to say that I am "a citizen of no mean city"—the city of Doppler and Loschmidt, of Stefan and Boltzmann.

It is obvious that a centre of learning that boasts of such names on its roll of honour would offer fertile ground for the new ideas so lavishly given to the world by Sir J. J. Thomson. Yet, apart from certain researches on ionic mobility and condensation, which were, so to say, imported directly from Cambridge, this Thomsonian influence on Viennese science is difficult to trace in detail, not because it is too slight, but, on the contrary, too universal; it is, to-day, all-pervading, like the air we breathe.

To the world of science in general, J. J. Thomson stands out as one of the great pioneers who, beginning in the last decades of the nineteenth century, blazed the trail for the new physics. But to the awe and veneration due to such a leading genius there is added for those who, like myself, were privileged to enjoy the genial hospitality of the Cavendish Laboratory years ago, a warmer, more personal feeling: it is the yearning for those unforgettable old days in Cambridge and for that band of inspired workers with J. J. Thomson as their centre.

Prof. A. SOMMERFELD, For.Mem.R.S.,
University of Munich.

May I be permitted to mention an activity of Sir J. J. Thomson's which has almost been lost in the shadow of his later brilliant successes, but nevertheless constitutes a characteristic feature in the record of this investigator; I refer to his "Recent Researches in Electricity and Magnetism"—the so-called third volume of Maxwell. He is dealing here with the good old mathematical physics, the actual formal treatment of special physical problems. Both in Maxwell's "Treatise," and in J. J. Thomson's continuation of it, these are found in equilibrium, so to say, with the new and specifically Maxwellian ideas; but in recent times they have been in danger of being suppressed under the weight of modern interests. It was thus that J. J. Thomson at first continued the great school of mathematical physics which arose in Cambridge under Green and Stokes. In this way he laid for himself and his students the solid foundations on which the researches on the electron could be built.

Modern physical theories are transient, the mathematical methods eternal; if they seem temporarily to be asleep, they revive again in previously unsuspected regions. This is illustrated in the theory of relativity, where the Riemann geometry suddenly sprang into physical life, and it is now illustrated in the quantum theory, which has recently come under the sway of the boundary condition problems of classical mathematical physics.

We hope that the physics of the future will not be lacking in men like J. J. Thomson, masters at once of physical problems and mathematical methods.

Prof. P. ZEEMAN, For.Mem.R.S.,
University, Amsterdam.

"*From the point of view of the physicist, a theory of matter is a policy rather than a creed; its object is to connect or to co-ordinate apparently diverse phenomena, and above all to suggest, stimulate, and direct experiment.*"—J. J. Thomson, "The Corpuscular Theory of Matter," p. 1, 1907.

The invitation to contribute a message to NATURE on the occasion of Sir J. J. Thomson's seventieth birthday, is one which I gladly accept, though I realise how difficult it will be to formulate in a few lines the feelings of admiration Sir Joseph's influence on physical science provokes in all parts of the world where science is flourishing. Whenever any one personally acquainted with Sir Joseph reads his name, they see in their mind's eye his powerful head and characteristic appearance, inspirations for an artist on various occasions.

It is a delight to inspect the photographs taken from

time to time in the Cavendish Laboratory during J. J. Thomson's tenure of the directorship and representing the professor surrounded by his research students. The influence Thomson has exercised upon his generation is nobly illustrated by these pictures. It is remarkable that so many of his former pupils are now filling important posts in other learned institutions and that several of them are in the very first rank of physicists. The photographs honour the great teacher, and at the same time set in a clear light the exceptional ability of the British mind to see the root of things.

A paper of great importance, "On the Electric and Magnetic Effects produced by the Motion of Electrified Bodies," appeared in 1881. Thomson showed that the magnetic field set up by an electrified particle in motion increases the apparent mass of the particle. Indeed, he gave us the first formula for the electro-dynamic mass. The investigation is a most remarkable example of early genius, its author being at the time only twenty-five years of age. Unintentionally, Thomson was preparing himself for his grand work on the true nature of the cathode rays and the isolation of the electron.

The profound mathematical insight of Thomson we can admire in his "Applications of Dynamics to Physics and Chemistry," published 1885–1887, forerunner of Hertz's "Prinzipien der Dynamik," written at a time when the mirage of a real kinetic theory of matter was firmly believed in.

Before the last-mentioned investigations were published, Thomson was giving a great deal of his attention to experimental work in the laboratory, and apparently he did so more and more. Thomson's papers reveal the talents of the experimenter and of the mathematician, combined in a most remarkable and happy way. Unfortunately this combination, which enables their possessor to penetrate into the hidden depths of Nature, is very rare.

During a period of forty-five years, the results of Thomson's restless mental activity and originality have been given to the world in a series of investigations happily summarised in several books published as the subjects became ripe for description. They all exhibit the clearness and conciseness which are characteristic of Thomson's writings. I refer here not only to the fundamental work on the "Conduction of Electricity through Gases," but also to the delightful smaller books: "The Discharge of Electricity through Gases"; "Electricity and Matter"; "The Corpuscular Theory of Matter"; and "The Electron in Chemistry."

Thomson's researches are often directed on questions relating to the deep and hidden nature of matter and electricity. He counts the number of electrons in the atoms; he arranges with his fertile imagination the electrons in coplanar rings inside a sphere of positive electricity; he gives us suggestions toward the explanation of the periodic law of the chemical elements; he gives us his views on the structure of light; and boldly explains some great difficulties of the old wave theory by his speckled wave front. A charming episode in the midst of these difficult investigations is the discovery of the isotopes of neon by Thomson's parabola method.

We hope that physics may still for many years benefit from Sir J. J. Thomson's labours.

Prof. JOHN ZELENY,

Yale University, New Haven, Connecticut.

Science knows no national boundaries. An important discovery made in one laboratory soon becomes common knowledge and has its stimulating effect upon investigators throughout the world. The influence of any individual scientist upon research work in countries outside of his own is dependent therefore to a large extent upon the pioneer character and importance of his investigations. Greatly indebted as physical research in the United States is to Sir Joseph Thomson on such grounds alone, there are special reasons why his influence has been even greater than this measure would indicate.

In the first place, during Sir Joseph's incumbency of the Cavendish professorship at Cambridge, physical research in the United States expanded enormously and spread to many institutions where previously little or none had been done. The inspiration that produced this growth was supplied in part by the few centres in our country where research was already thriving, and this influence must not be under-estimated. But the eyes of the scientific world were upon Sir Joseph and the Cavendish Laboratory, because from this source in rapid succession new ideas were being brought to light that were making a very deep impression on scientific thought. It was inevitable that this activity should spur men on to do research work and to choose as the field of their endeavour the one that was yielding such remarkable results.

Another important channel through which Sir Joseph's influence was disseminated in the United States was through those of our men who in this period worked under his direction in the Cavendish Laboratory. Many of these men already held influential positions in our universities, and on returning imparted to an increasing circle the enthusiasm for research which they had absorbed at the fountain-head.

Mention must be made, too, of the beneficial effect upon our research men of Sir Joseph's visits to the United States and of the lectures he gave there. Large numbers were thus not only able to hear him explain his most recent theories but also to benefit greatly from an intimate discussion with him of their own problems.

Those of us who had the rare privilege of working with Sir Joseph at the Cavendish Laboratory count the years spent there as among those that we cherish most. We lived in an atmosphere sparkling with new thought. We enjoyed a free and happy comradeship. New ideas and interpretations of experimental results had to stand the test of friendly but none the less vigorous criticism. We experienced the thrill of being present when important discoveries were in the making, and day by day we were permitted to observe the working of Sir Joseph's penetrating and resourceful mind.

Over and above all is the fact that this great man is wonderfully human. One cannot forget his many interests, his kind heart and lovable nature, his humour, the cheerfulness he radiates, his hospitality, and his readiness to serve others. To know him is to have for him a reverence and affection that but grows with the years.